POPULAR SCIENCE Monthly

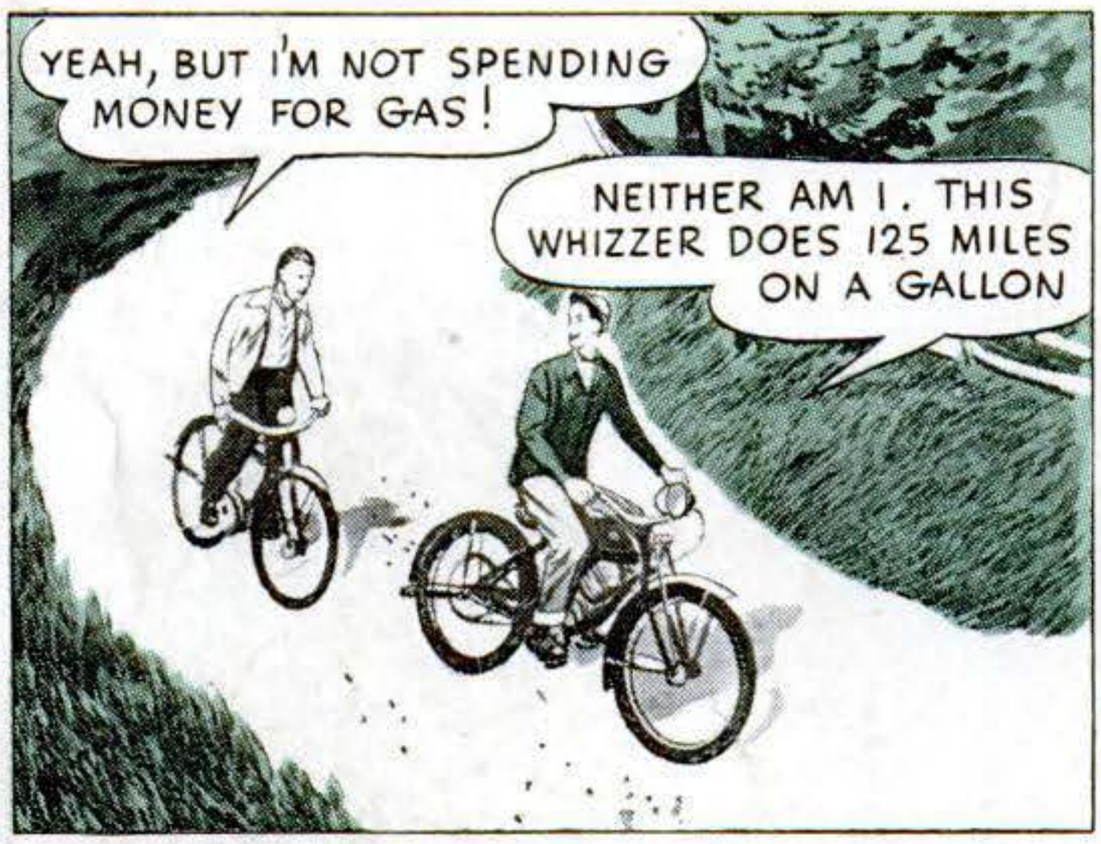
July 1949

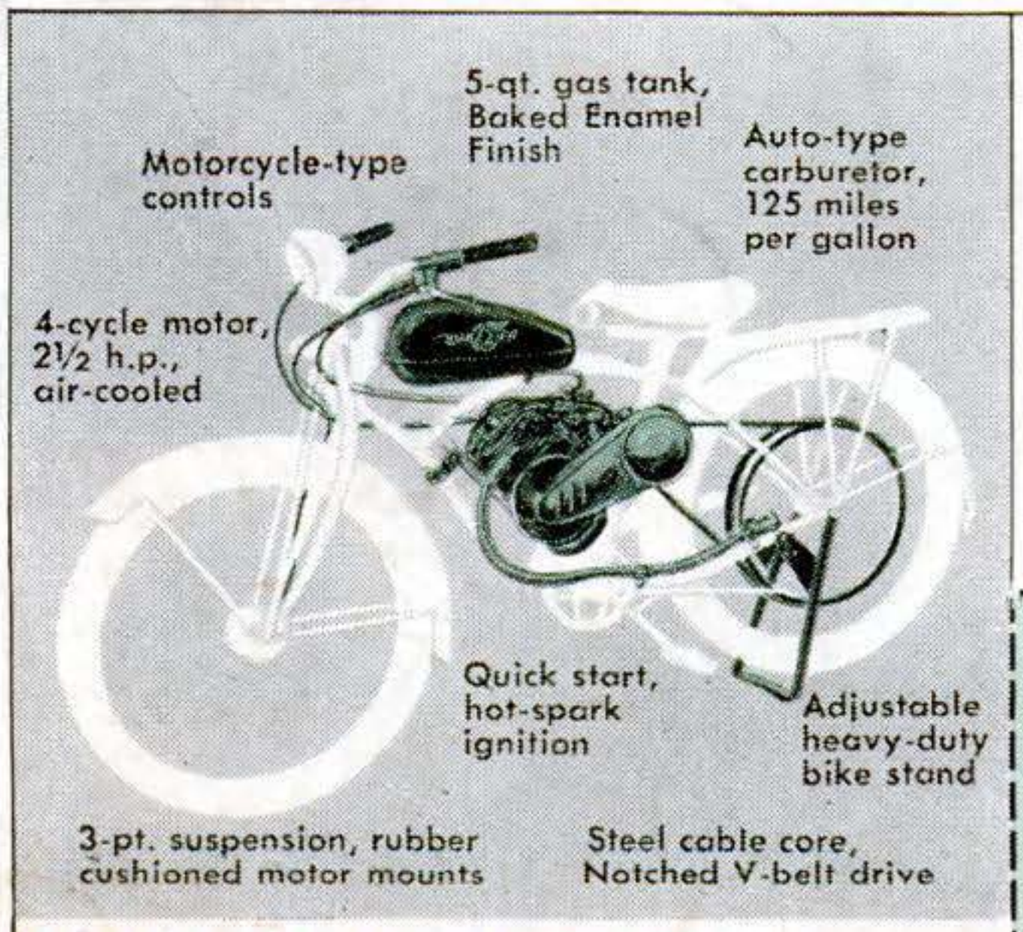
25¢

How You Are Thrilled ...but Not Killed

PAGE 82

"Hey Jack, put a *Whizzer** on it!"





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I'd like the full Whizzer story. Please send catalog.

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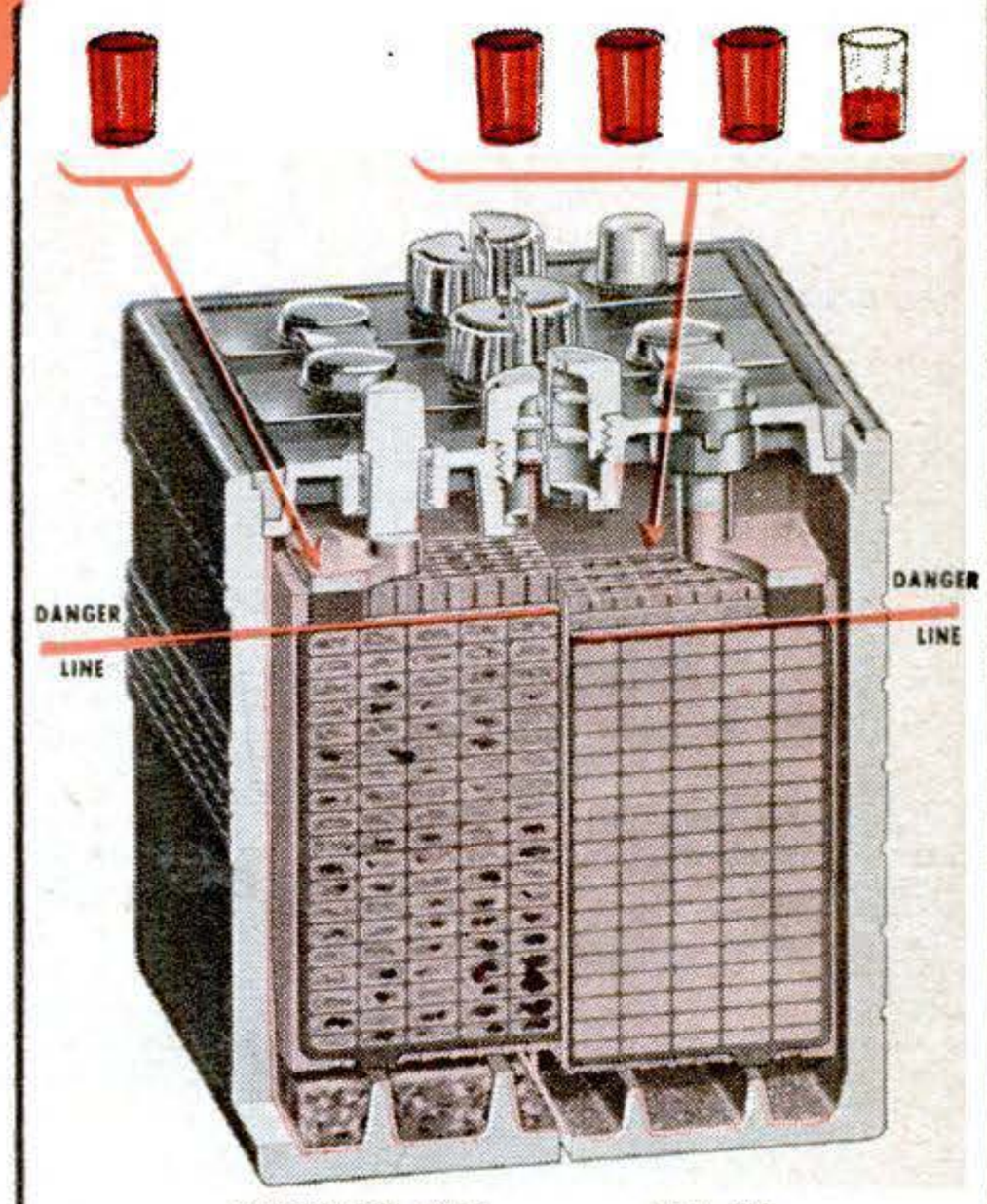
AUTO-LITE Sta-ful BATTERY...*needs water only 3 times a year**

A revolutionary new development, the Auto-Lite "Sta-ful" Battery, protects you against a major cause of battery failure . . . damage to plates due to liquid loss. This new "Sta-ful" Battery design permits a liquid reservoir with 3 times the capacity of ordinary batteries . . . keeps plates fully covered and active months longer in normal car use.

In addition, "Sta-ful" has extra plates for greater electrical capacity . . . Fibre-glass mats to hold the power-producing material in those plates for longer battery life. To get more for your battery dollars, replace with an Auto-Lite "Sta-ful". Money cannot buy a better battery.

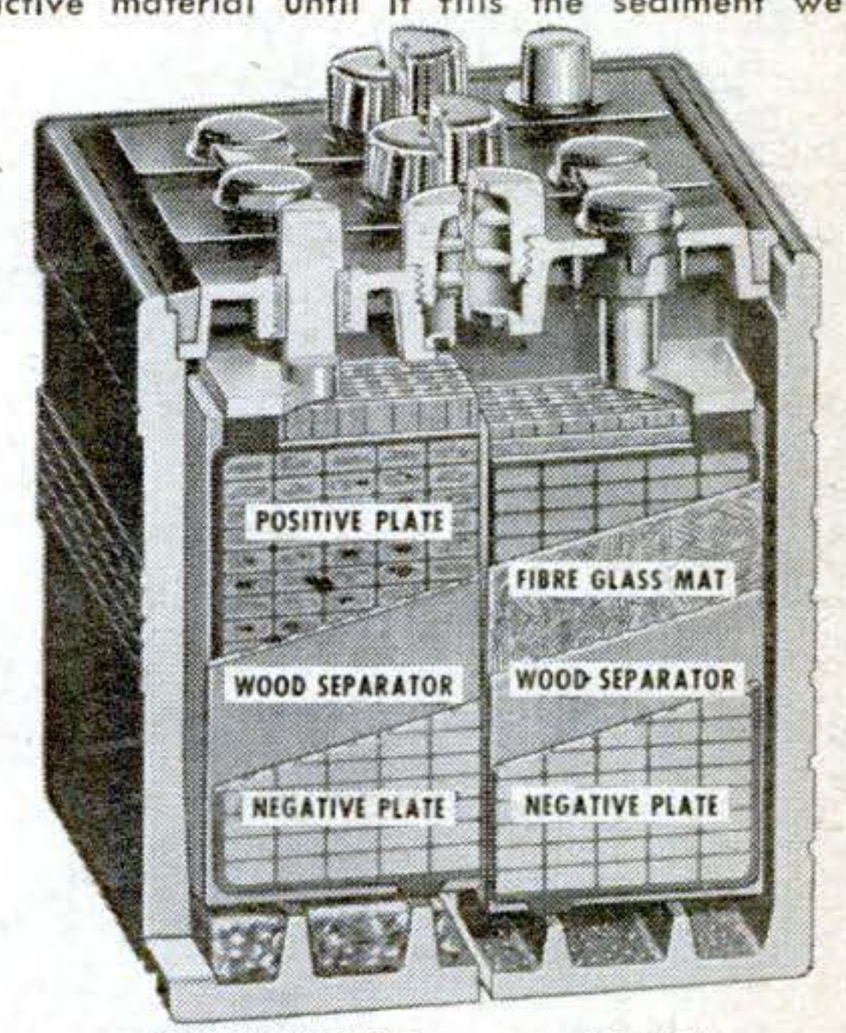
AUTO-LITE BATTERY CORPORATION
Toledo 1 Ohio

Because of a unique construction, the new Auto-Lite "Sta-ful" Battery holds more than 3 times the liquid reserve of ordinary batteries.

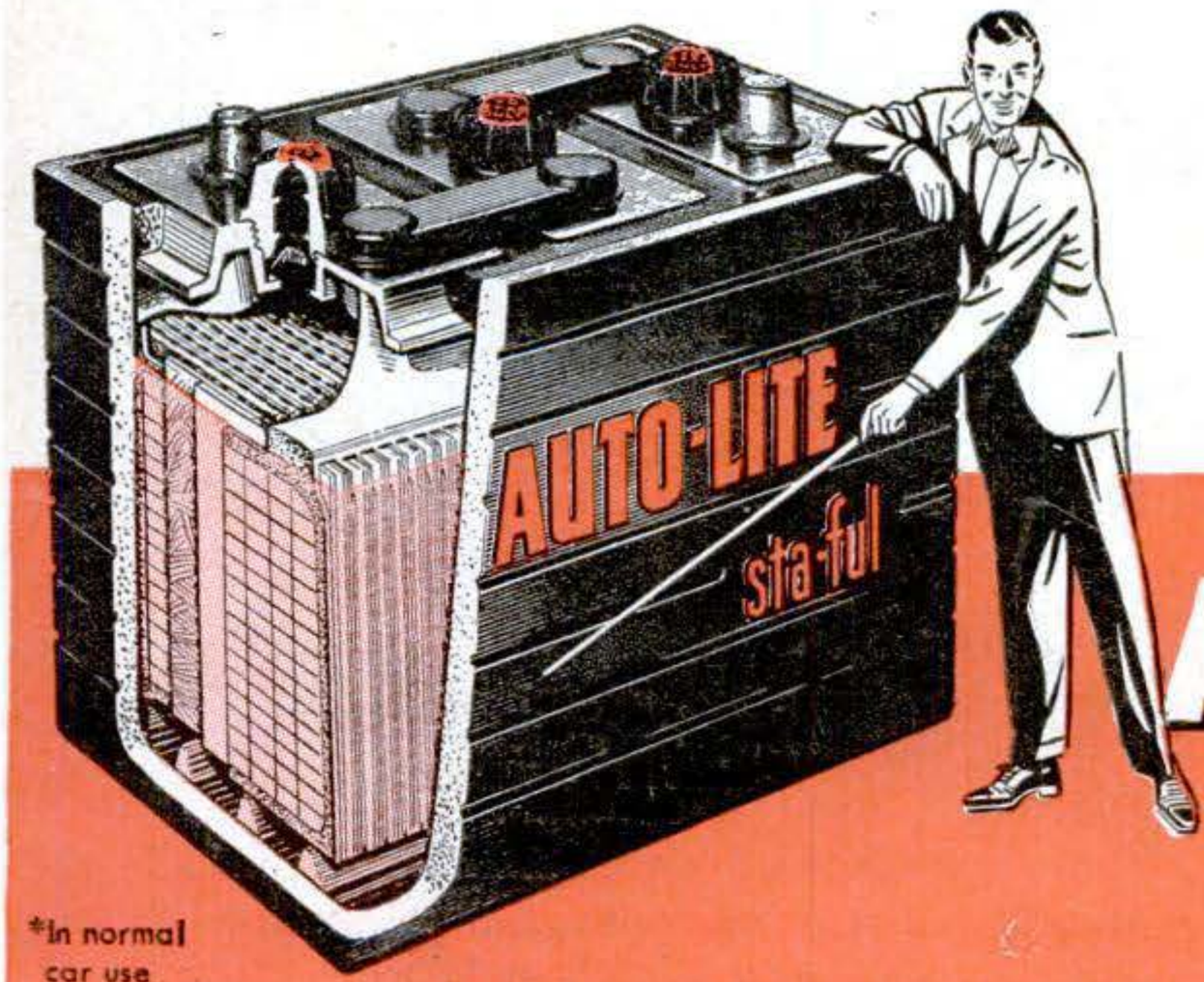


ORDINARY TYPE STA-FUL

Note how the protective Fibre-glass mat retains the power-producing material in the positive plate while ordinary battery plates shed the active material until it fills the sediment well.



ORDINARY TYPE STA-FUL



*In normal car use

AUTO-LITE Sta-ful BATTERIES

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POPULAR SCIENCE

MECHANICS AND HANDICRAFT *Monthly*

JULY, 1949

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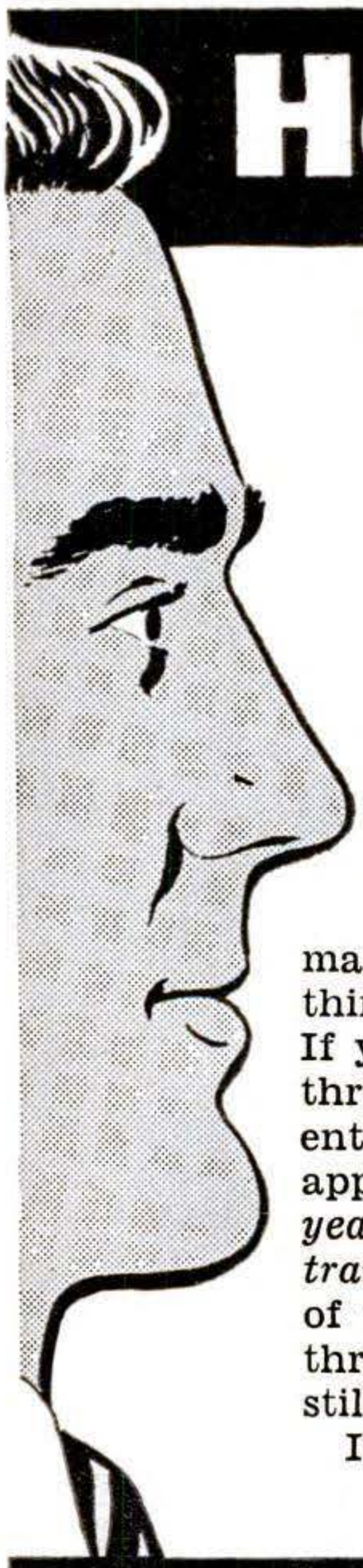

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Present Position_____ Employed by_____

Length of Service in World War II_____

Enrollment under G.I. Bill and P.L. 16 approved for World War II Veterans. Special tuition rates to members of the Armed Forces. Canadian residents send coupon to International Correspondence Schools Canadian, Ltd., Montreal, Canada.

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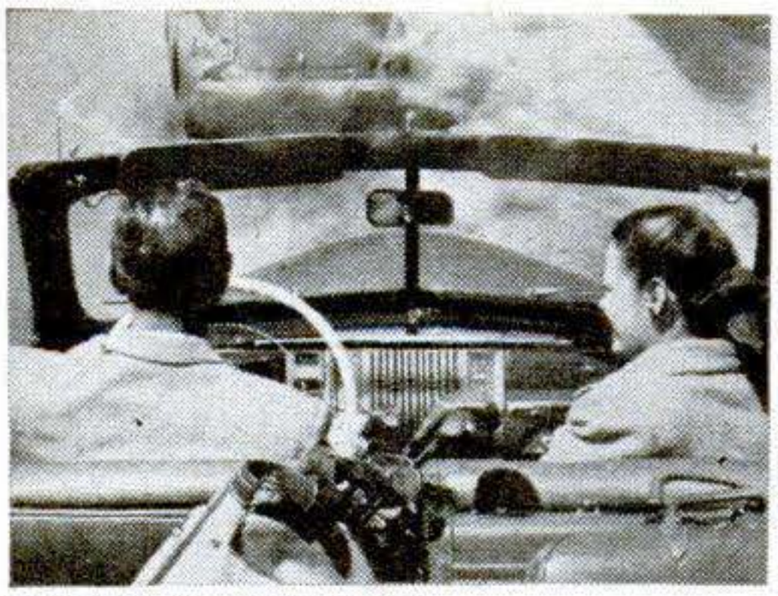
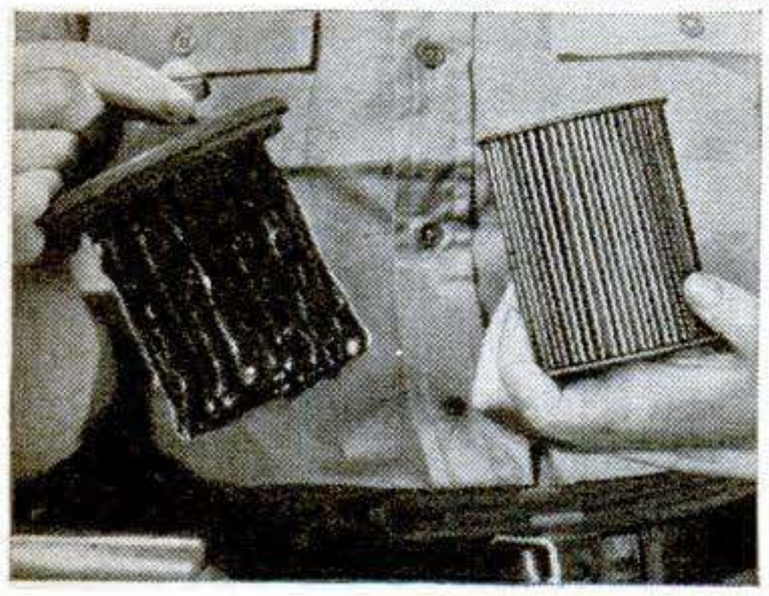
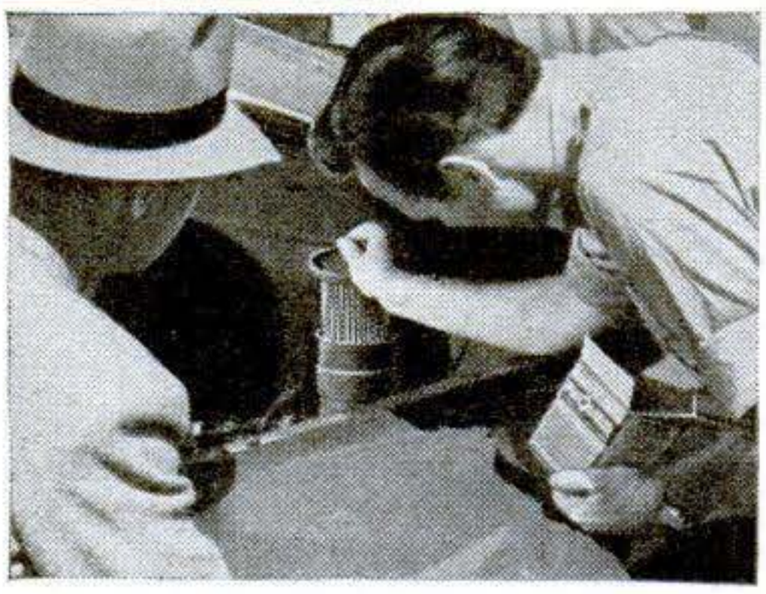
Time to "Summer-Proof" your Oil filter



SUMMER'S HARD ON OIL FILTERS. Long trips pile up mileage, speed the formation of sludge. Dusty roads load your oil with engine-wrecking abrasives and dirt.



MICRONIC REFILL A MONEY-SAVER. No other oil filter compares in dirt-absorbing capacity. No other filter keeps your oil so *clean*, repair bills so low.



OUT WITH THAT CLOGGED-UP CARTRIDGE. Insert a Purolator Micronic Refill...to help check engine wear, forestall an untimely overhaul or repairs.

Make your next oil change complete . . . new oil and a new filter refill. Insert a Purolator Micronic Refill. Traps *all* the engine-wrecking sludge and abrasives. Fits almost all filters. $1.38 to $2.50, depending on make of car; inserted in a few minutes.

If your car is *not* equipped with an oil filter, install a Purolator, $6.50, or a bit more, also depending on make of car. Purolator Products, Inc., Newark 2, N. J., and Windsor, Ontario, Canada.

PurOlator

MICRONIC **OIL FILTER**

Clean oil = a clean engine = lower repair bills

New Products

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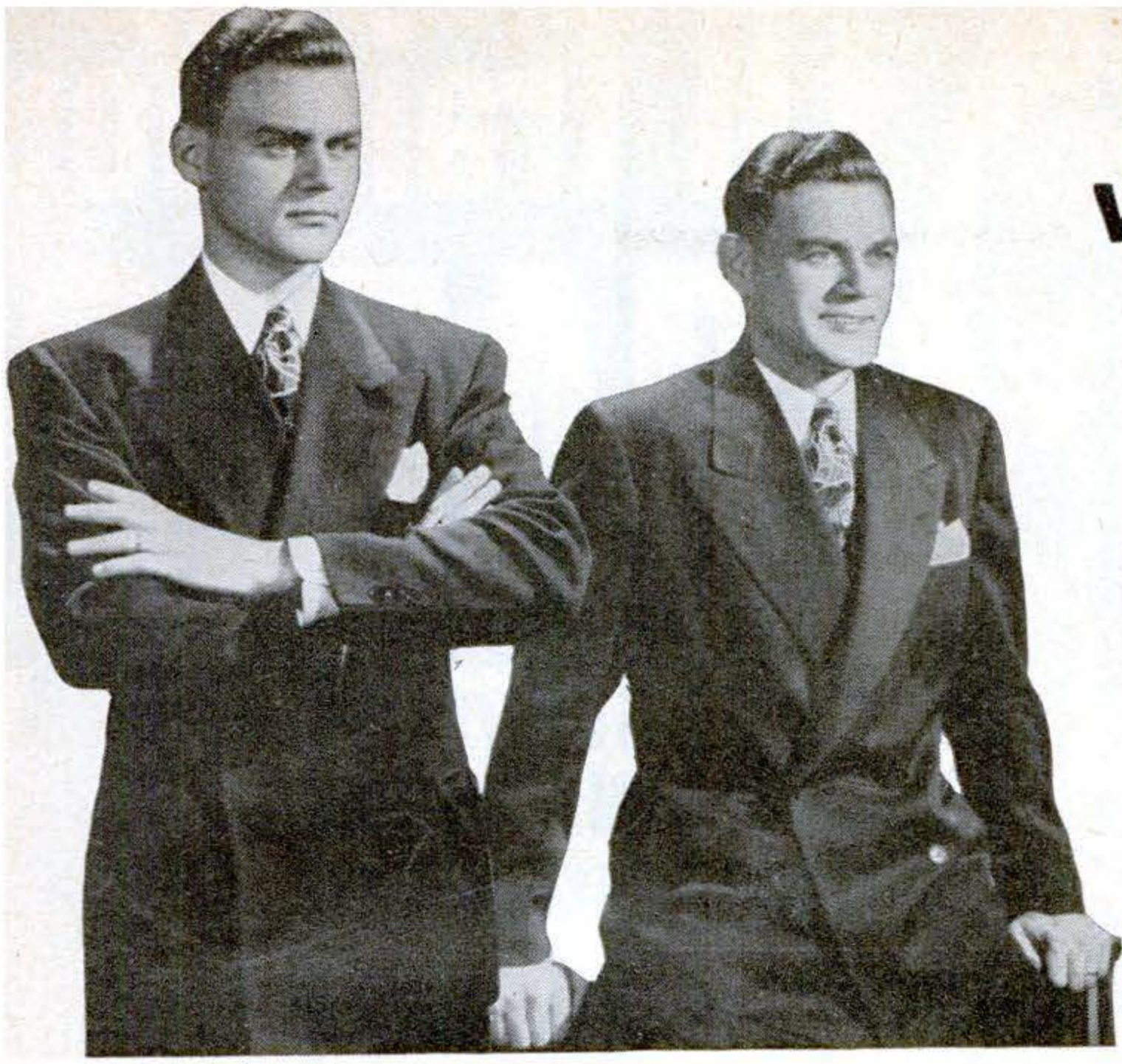

If YOU were *Boss* would YOU *promote* "YOU"?

Business is always willing to pay the man who knows —and pay him well. The man who is ready and willing to take responsibilities—and capable of directing the efforts of other men is a valuable asset to any business organization. He never wants for a good job and above average earnings. He gets ahead.

We have helped thousands of men achieve promotion and more money—success sometimes beyond their dreams—a success that was started by a coupon similar to the one below.

Get out of that rut—don't be satisfied with a mediocre job at small pay—be a success in business—this coupon may be your first step.

Mail the coupon and we'll include "Ten Years' Promotion in One"—a book which has helped many men. Do it today—tomorrow never comes for the man who consistently puts things off.

Be honest now—

suppose that a better job had opened up in your company—carrying with it promotion and more money—could you qualify?

If you were boss, would you select "YOU" for that better job?

Consider before you answer.

First of all, could you *fill* the job? Has your experience fitted you for the step forward—have you been preparing for promotion apart from experience gained on the job?

Or have you just been filling a niche, doing daily tasks well but making no real and intelligent effort to learn and qualify for the job ahead so that if an opening should occur you would be ready to fill it?

The man who gets real promotion is the one who makes his own breaks—the man who slaves in the ordinary job at low pay just wishes and dreams of promotion and more money. Which are you?

LASALLE EXTENSION UNIVERSITY
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Dept. 783-R Chicago 5, Illinois

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Please send me your free 48-page booklet telling how I can succeed in the field I have checked below—plus "Ten Years' Promotion in One" without obligation.

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- ☐ **C.P.A. Coaching**
- ☐ **Bookkeeping**
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- ☐ **Business Management**
- ☐ **Salesmanship**
- ☐ **Traffic Management**
- ☐ **Foremanship**
- ☐ **Industrial Management**
- ☐ **Stenotypy (Machine Shorthand)**

Name..... Age.....

Address.....

City, Zone, State.....

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I'll Train You RADIO-

I Trained These Men

M. JOSEPH, Sacramento, Calif., says, "Before ... ing your course ... $10 a week in ... After graduati... manager of st...

V. MARCHESA ... phia, Pa., write ... ishing my N.R.I. ... have been busy ... pairing and in ... vision."

S. W. DINWIDDIE ... ville, Ill., writes, "S... finishing course, wo... servicing shop. No... Engineer of WCUN ... Police Radio Instal...

A. HERR, New C... Pa., writes, "Hav... doubled my salary since start... ing in Radio full time. Am employed by Station WKBO as transmitter operator. Future looks bright to me."

L. M. HAUGER, San Bruno, Calif., tells us that "N.R.I. helped qualify me for job as Radio Mechanic with United Airlines. Have my Radiotelephone 2nd Class License."

L. ARNOLD, Pontiac, Mich., says, "While learning, I made from $5 to $10 a week in spare time. Now I am earning as high as $25 a week in my own spare time shop!"

M. LINDEMUTH, Ft. Wayne, Ind., writes, "When I started N.R.I. Course, didn't know a condenser from a resistor . . . but was soon averaging over $9 a week in my spare time."

H. B. MILLS, Washington, Ohio, finds, "Word traveled fast in regard to my N.R.I. training. Have been doing Television installation and servicing, tracing out and eliminating interference, etc."

C. STAETH, Fort Madison, Iowa, informs us, "Do Radio Servicing full time in my own shop and am making more money than ever before. I owe this to N.R.I."

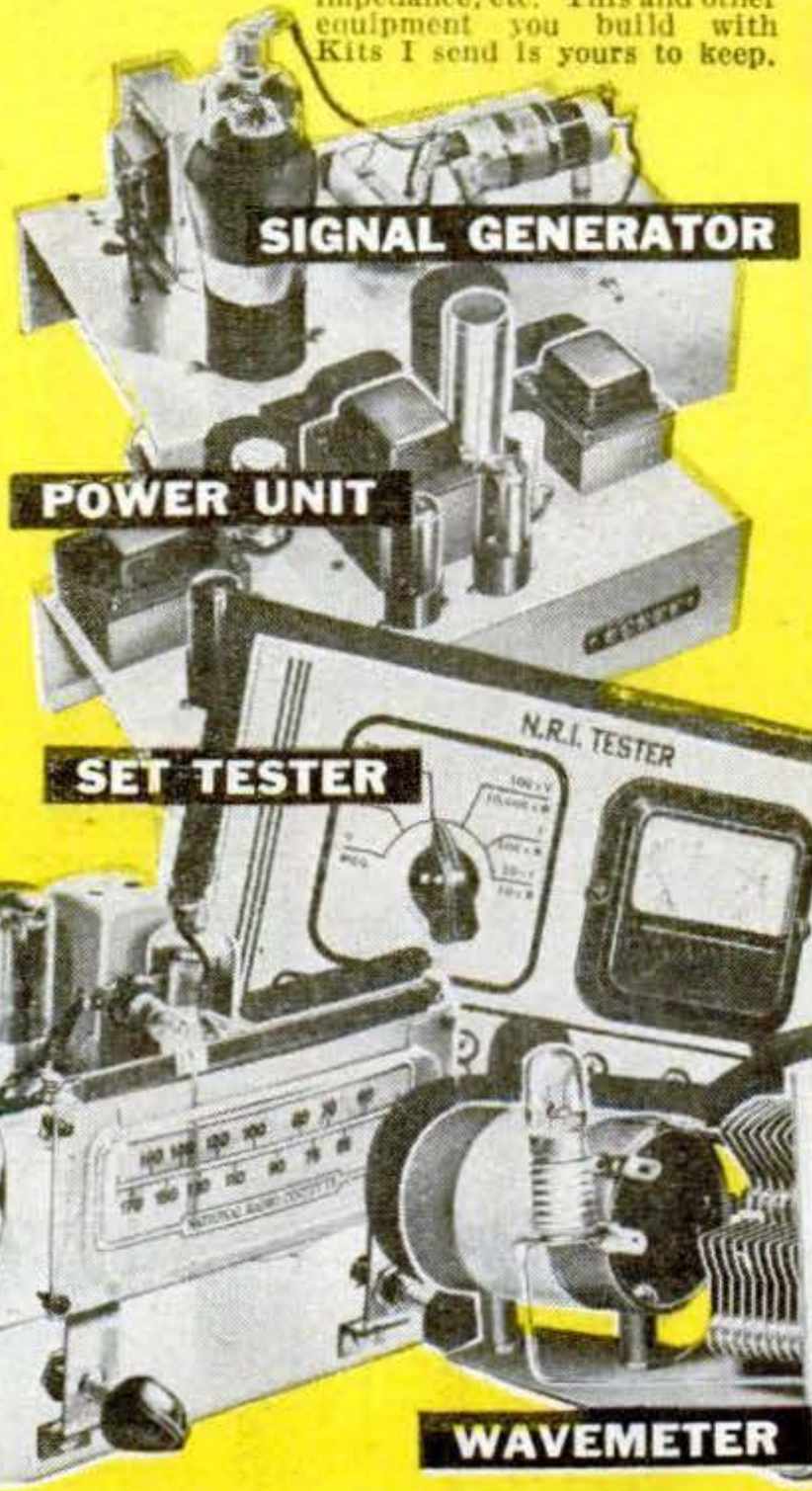
T. S. NORTON, Hamilton, Ohio, says, "My first job was obtained for me by your Graduate Service Department. Am now Chief Engineer, Station WQOX."

W. R. NIC... writes fro... ng in ... trol ...

PRACTICE SERVICING OR COMMUNICATIONS

I Send You Many Kits

For both my Servicing Course and my NEW Communications Course, I send you many Valuable Kits of Parts for PRACTICAL EXPERIENCE. They "bring to life" theory you learn in my illustrated texts. Some equipment from both courses is shown below. As part of my Servicing Course, you build a complete, powerful Radio Receiver, a Set Tester useful in earning extra spare time money, an A. M. and F. M. Signal Generator, etc. In my Communications Course, you assemble a low-power Broadcasting Transmitter that shows how to put a station "on the air," a Wavemeter, an Electronic Multitester for measuring voltage, current, resistance, impedance, etc. This and other equipment you build with Kits I send is yours to keep.



You Can Have a Business of Your Own

Many N.R.I.-trained men each year start their own Radio-Television sales and service business without capital. Let me show you how you, too, can be your own boss, have a good income from your own shop. Robert Dohmen, of New Prague, Minn., shown above standing in front of his store, writes that he is "now tied in with two Television outfits and does warranty work for dealers."

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AT HOME for Good Jobs in TELEVISION

There is Success--Good Pay--Security for You in America's Fastest Growing Industry

Make Extra Money Fixing Radios in Spare Time While Learning

I send you SPECIAL BOOKLETS that show how you can earn $5, $10 a week in your spare time fixing neighbors' Radios . . . and I send you parts to build SET TESTER that helps you do it. Frank J. Lhotsky, of Cicero, Ill., shown above in his workshop, was one of my many students who earned money while training.

VETERANS
GET THIS TRAINING WITHOUT COST UNDER G. I. BILL

Do you want a good-pay job in the fast growing RADIO-TELEVISION Industry? Or do you want to have your own money-making Radio-Television Shop? Here is your opportunity. I've trained hundreds of men to be successful Technicians . . . MEN WITH NO PREVIOUS EXPERIENCE. My tested and proved train-at-home method makes learning easy. You learn Radio-Television principles from my illustrated lessons. You get practical experience building, testing and experimenting with MANY KITS OF PARTS I send. All equipment yours to keep.

Make Extra Money In Spare Time

The day you enroll, I start sending you SPECIAL BOOKLETS that show you how to make $5, $10 a week or more EXTRA MONEY fixing neighbors' Radios in spare time while learning. From here, it's a short step to your own shop or a good-pay Radio-Television servicing job. Or be a licensed Radio-Television Operator or Technician.

Television Offers Bright Future

In 1945, there were 943 Radio Stations. Today, about 2700 are on the air! RESULT—THOUSANDS OF QUALIFIED MEN STEPPED INTO GOOD JOBS. Another example—only 19 Television Stations were on the air in 1947. Today, more than fifty. Within a few months, 150, say the experts—and 1000 within three years. Then add developments in FM, Two-Way Radio, Police, Marine, Aviation, Microwave Relay Radio. Think what this means! New jobs, more jobs for qualified men. The man who prepares NOW can reap rich rewards in this changing, developing, fast growing field!

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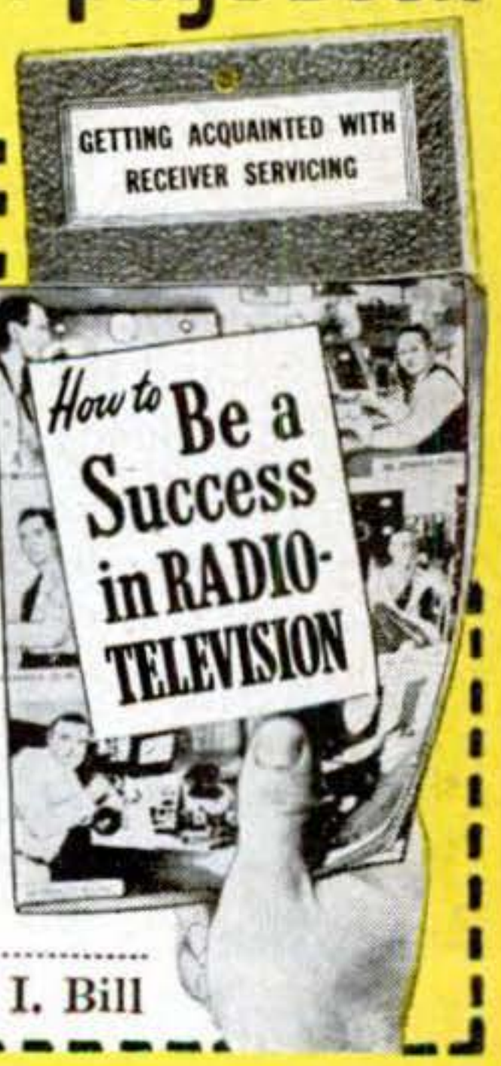

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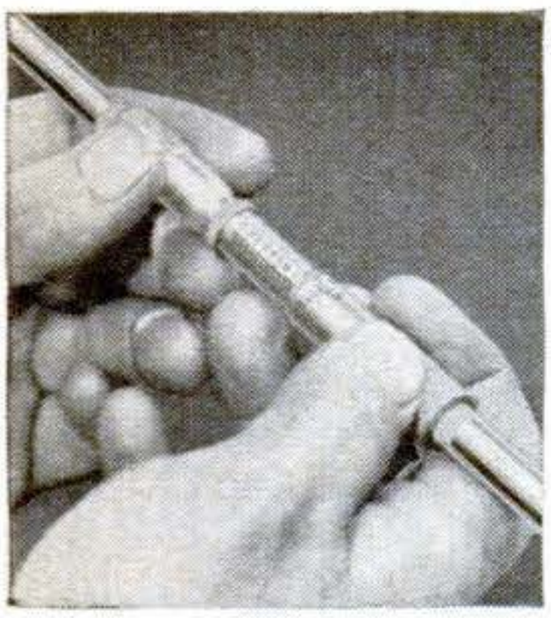

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Letters

Blackett on the Bomb

Sir:

I fully understand that there are many points in my exposition [of the atomic bomb's role in a war between major powers] that are open to doubt and criticism. You are certainly correct in supposing that certain key target systems such as oil might be a vulnerable point in a country's defense. Clearly if this is so, then the defending country is likely to be extremely secret about the location of its reserves, storage, plants, etc. It is not possible to be quite sure what would happen in a future war with atomic bombing against Russia, and it is possible that the Russian oil industry could be effectively destroyed. However, I do not feel that this is by any means certain.

P. M. Blackett

The Physical Laboratories
The University, Manchester, England

Nobel-prize-winner Blackett is the author of "Fear, War, and the Bomb." His views were summarized and criticized in PS (May '49, p. 124).

Old Idea, New Difference

Sir:

It is interesting to note that the fixed "convertible" type idea is not new, but was used by Studebaker almost twenty-five years ago, PS, May, page 134. The Studebaker Duplex Phaeton came in three sizes: Standard Six, Special Six, and the Big Six. The price of the Special Six sedan as of November 1924 was $2,150. The price of the Special Six Duplex Phaeton was $1,495, nearly $700 less. Today, the fixed convertible models sell for as much as $1,000 *more* than the sedan models.

James M. Strong, Jr.

West Hartford, Conn.

How to Make a Moon

Sir:

Willy Ley usually has no trouble backing up his statements, and I am curious to see if he can prove one he makes in "Is U. S.

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Learn how to protect your invention. The U. S. Patent Laws provide that any new and useful art, machine, article of manufacture, or composition of matter, or any new and useful improvement thereof, may be patented if the act of invention is involved. Therefore, every inventor with a valuable invention should take advantage of the Patent Laws and proceed for patent protection in order to safeguard his rights.

A patent gives the inventor the exclusive right to prevent others from making, using, or selling the invention claimed in the patent for a period of seventeen years.

The Patent Laws were enacted for the benefit of the inventor to give him protection for the features of his invention which are patentable. These features must be properly and concisely set forth and claimed in a formal application for patent, in order to comply with the requirements of the Patent Laws. For that reason, unless the inventor is familiar with patent matters, he should engage a competent registered patent attorney or agent to represent him. We are registered to practice before the U. S. Patent Office and are prepared to serve you in the handling of your patent matters.

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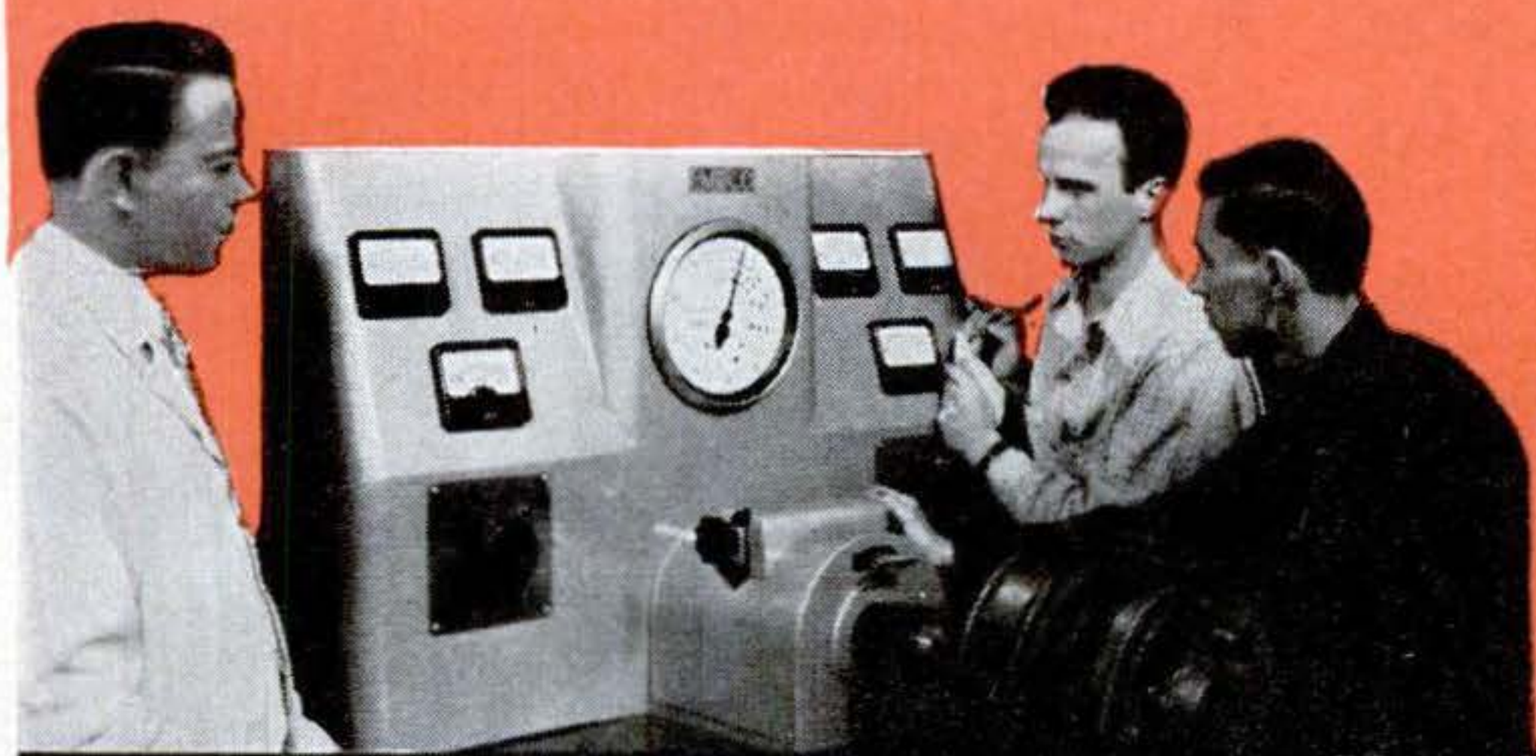

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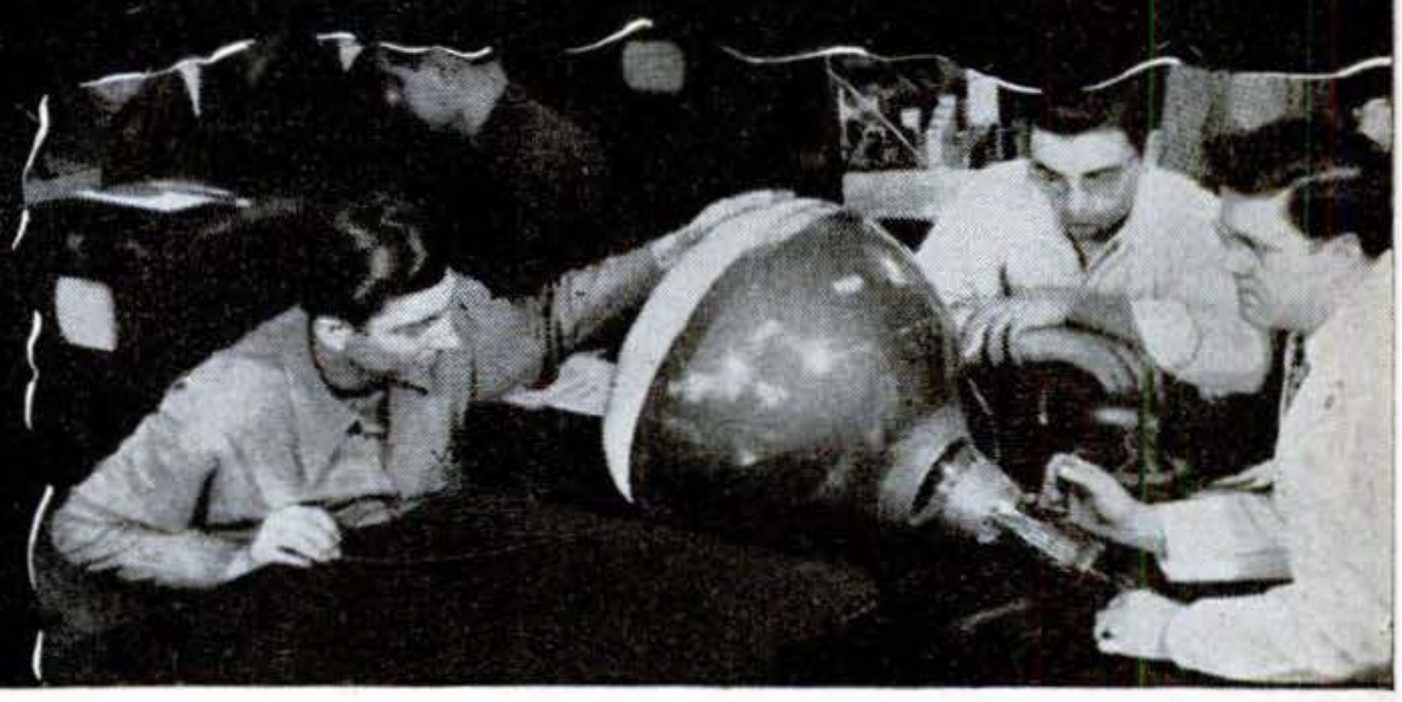
F.M. (Frequency Modulation)
RECORD CHANGERS
AUTO RADIOS
AIRPLANE RADIOS
PUBLIC ADDRESS Systems

(Right — Instructor explaining operation of 20-inch Cathode Ray tube used in Dumont Television Set.)



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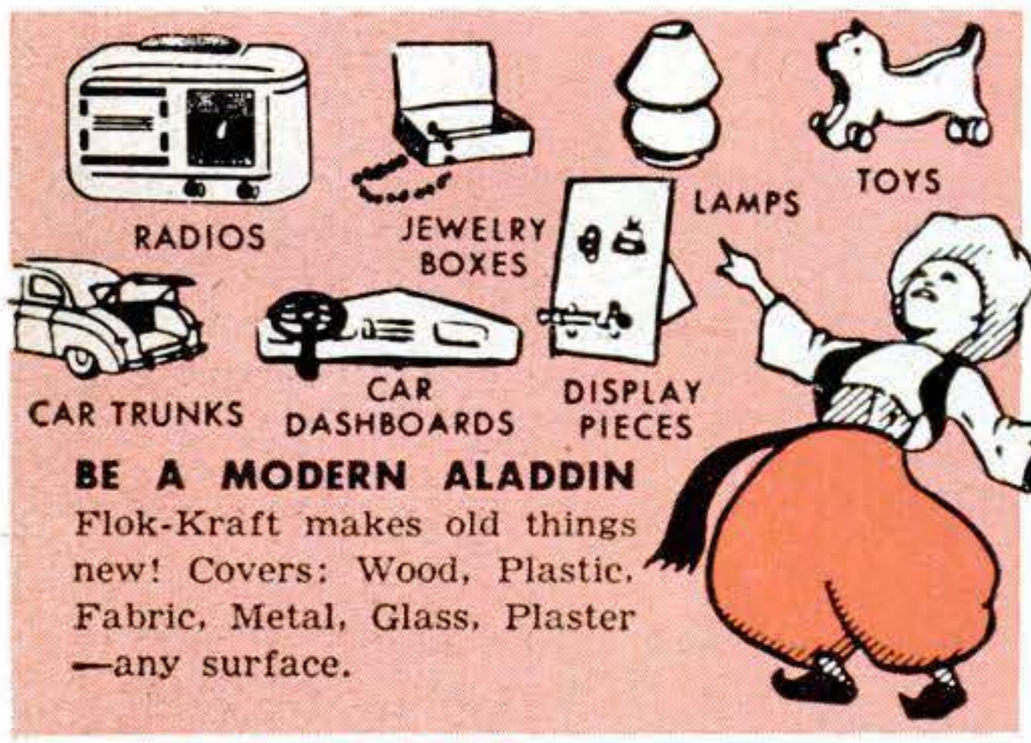

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Building a New Moon" [PS, May '49, p. 106]. He states that a 10,000-m.p.h. craft could never slip out of the grip of earth's gravity. If he means that this holds true with those fuels we now have at our disposal, he is probably right.

But we should some day, in the not-too-distant future, perfect an atomic drive for space craft. With an ample fuel source, such as an atomic drive would have, what is to prevent a space craft from accelerating to 10,000 m.p.h. and holding that speed with the power on until it reaches the neutral point of gravitational influence between the earth and the moon, or even Mars or Venus?

NEIL J. CRANDALL

Denver, Colo.

Sir:

. . . Why a three-stage rocket? The exhaust velocity of five miles per second can easily be reached with hydrogen and oxygen fuel. . . .

DONALD RADFORD WRIGHT

Felton, Calif.

Let Willy Ley speak for himself:

Since the whole article was devoted to the proposition of an orbiter with chemical fuels, atomic energy was clearly not under consideration.

The reason for making the rocket a three-step rocket, and for calculating the weights which I used in my article, is that I wanted to show that the orbiter could be established by the use of well known and well tried fuel combinations, namely watered alcohol and liquid oxygen. I know, too, that hydrogen will produce higher exhaust velocities—in fact almost three times as high as those used in my calculations. But it is not yet a well tried fuel; we don't know how long the motor would stand up.

Besides, hydrogen is not quite as wonderful as its high exhaust velocity may seem to indicate. Because it is of very low density, even when liquid, the rocket would need very large tanks, which would reduce the ratio between take-off weight and dead weight.

PS Bird House Wins Prize

Sir:

I've always wanted to write and tell you how I enjoy your magazine and how useful it always is. I've been reading your maga-

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TRAIN IN MIAMI -- AIR CAPITAL OF THE WORLD

zine since I was a boy in school and still do. It also is such an inspiration to my son and keeps him busy doing and making projects from plans in the magazine, for which I am very thankful. My son recently built a birdhouse from plans in your April issue [p. 197] and won first prize for the senior division in a competition sponsored by the Cleveland Bird Club. I have never seen him as happy.

EDWARD L. SEMALA

Cleveland, O.

Anyhow, It Was a Good Idea

Sir:

We have noted on page 108 of your February issue, under "I'd like to see them make . . .," a reader's suggestion calling for a "homogenized" paint. We, also, have had our turn thinking about the "ideal paint," which would not settle out of suspension and, as most paints do, form a hard cake of pigment on the bottom of the can. The idea grew and became so compelling that we got busy and produced just such a paint.

CALVIN C. WOLFE

National Paint Co.,
Seattle, Wash.

Sir:

. . . We have been making homogenized paint for a year and a half. . . .

ROBERT M. LONGMAN

Longman & Martinez,
Brooklyn, N. Y.

Easier Way to Etch

Sir:

I read with interest your article "How to Etch Aluminum" [PS, April '49, p. 200]. I have done many etchings on copper, zinc, and aluminum. As the authors point out, the usual method is to employ an acid—usually muriatic (hydrochloric) to etch the surface of the plate. This is necessary for copper. However, with either zinc or aluminum there is a much faster and simpler etching solution that I have found extremely satisfactory. This is a solution of cupric chloride, or so-called copper chloride. It comes as a blue powder or crystals and is much safer and easier to handle than an acid solution.

To use, you merely put two or three teaspoonfuls in about a half to a pint of water (the amount is not critical), in which it is

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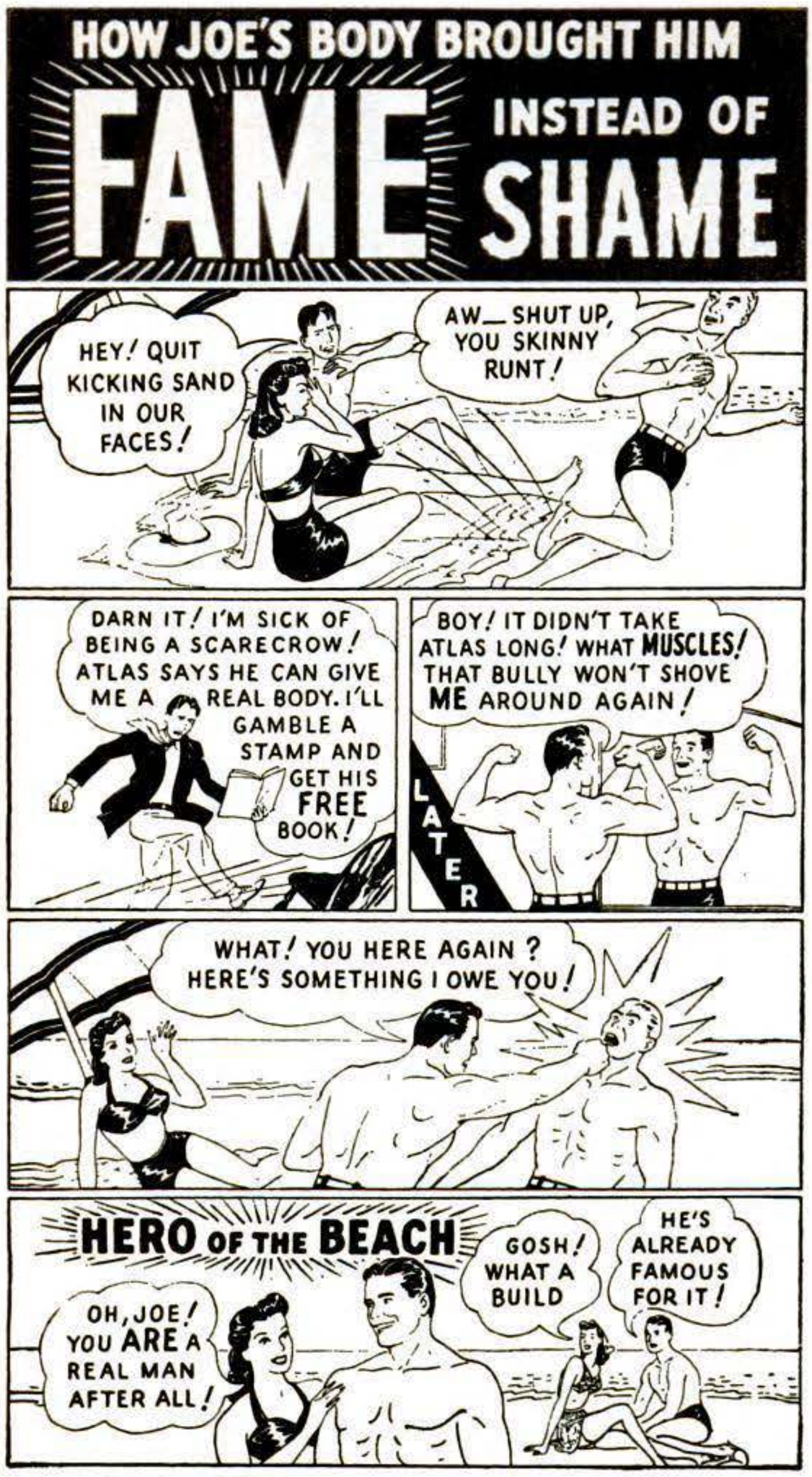

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readily soluble. Then the prepared plate is flooded with the solution and almost immediately bubbles of gas will appear, showing the metal is being acted upon.

The total time for this operation is only a few minutes—depending upon the strength of the solution. I have often completed a "biting" in three minutes. Also, there are no fumes or obnoxious smells.

HORACE F. W. WARDEN, M.D.

Dearborn, Mich.

Emergency Zipper Repair

Sir:

Your article on fixing zippers [PS, April '49, p. 209] shows a perfect repair job but does not give the answers for a quick remedy in an emergency. I have worked out two such answers:

Where tools are available, the slide can be opened wide and reinstalled at the "open" end. By clamping it shut there, the job of closing the zipper is eliminated.

Where tools are not available, it is possible to put the slide back on the track by cutting the track near the "open" end and starting this into the slide. This emergency method proved very useful to me when a trousers zipper failed during a train journey.

O. A. HANSEN

Kenmore, N. Y.

PS Takes a Trip

Sir:

In March, 1947, I heard over the radio an appeal for packages of food or clothing for Europe. The station offered to supply names and addresses of persons in practically every country.

Holland was always an interesting country to me—because of the wooden shoes and windmills, I guess; so I wrote for the name of a family in Holland. I got the name of a man who had been a POW in Germany for nearly five years. The letter said that he and his wife had three children.

I made up a package of foodstuffs, including plenty of candy and bubble gum, and slipped into it an issue of POPULAR SCIENCE. Two months later I got a letter by air mail stating that he had received my package and that WONDERFUL MAGAZINE. Now I send him some about every three months.

FORREST G. IRWIN

Springfield, O.

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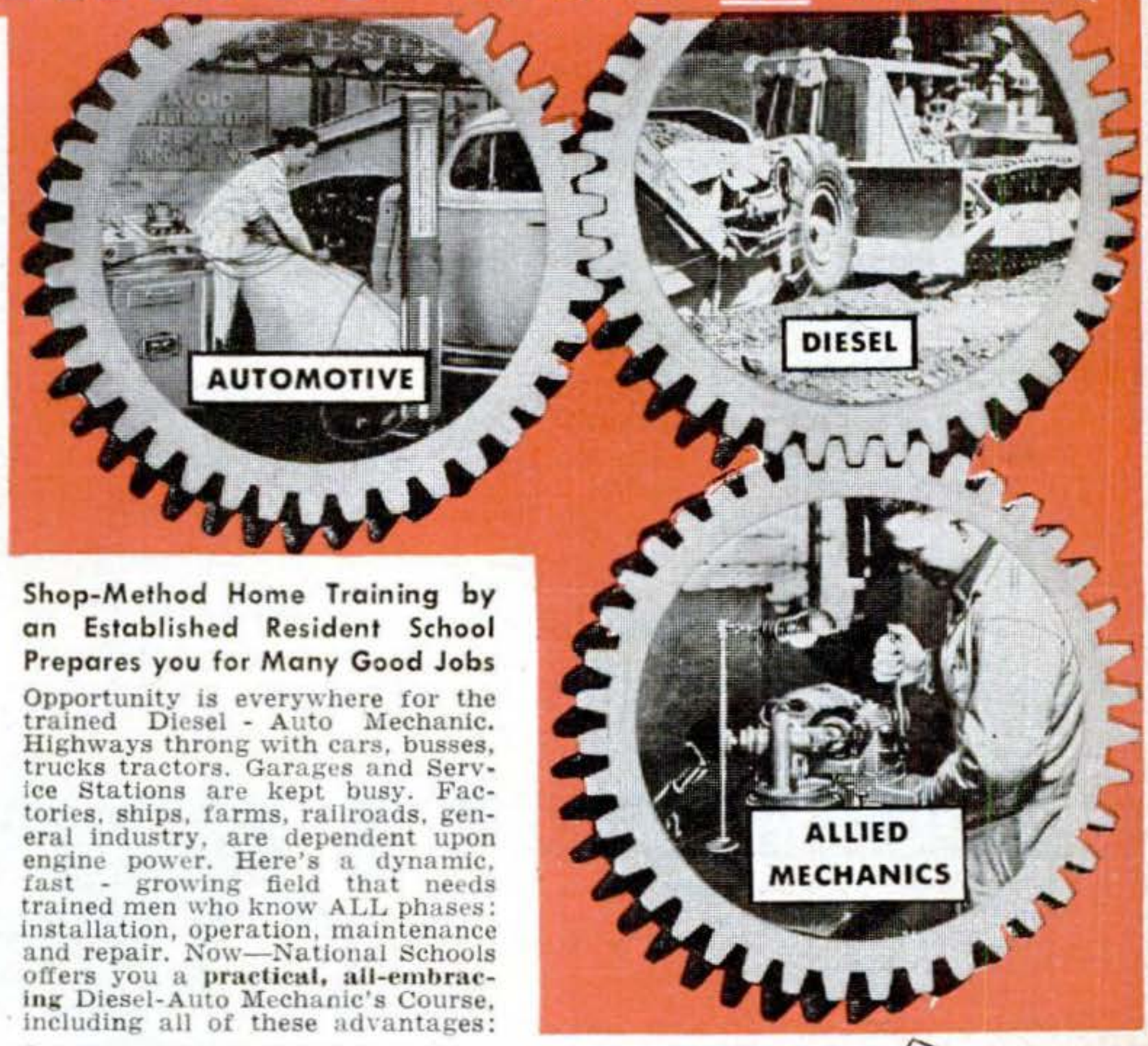

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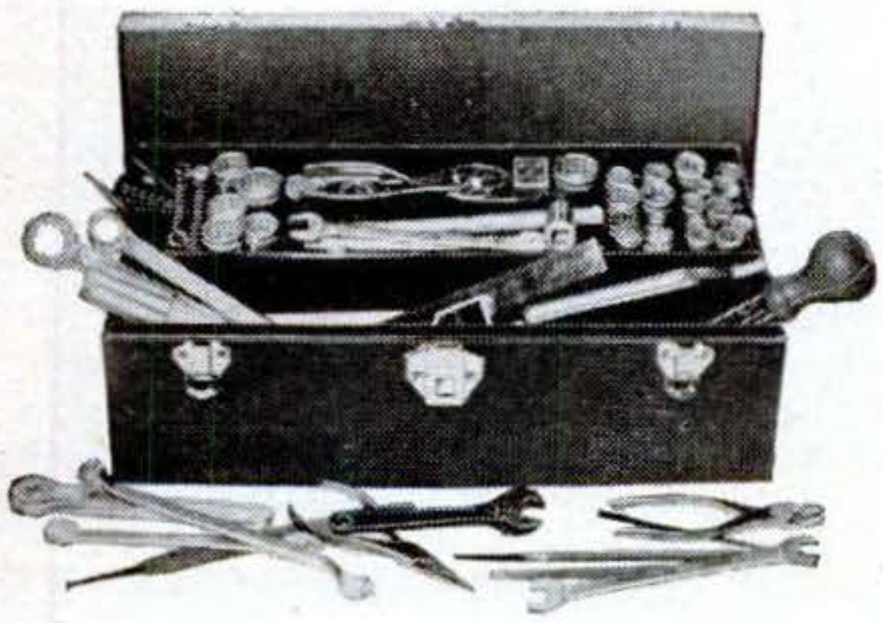

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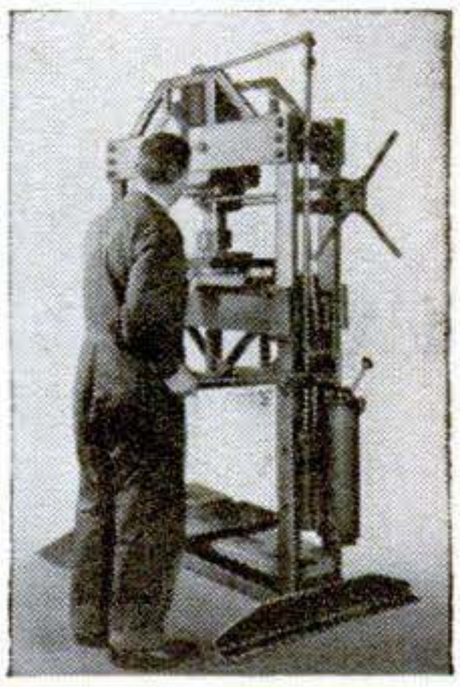

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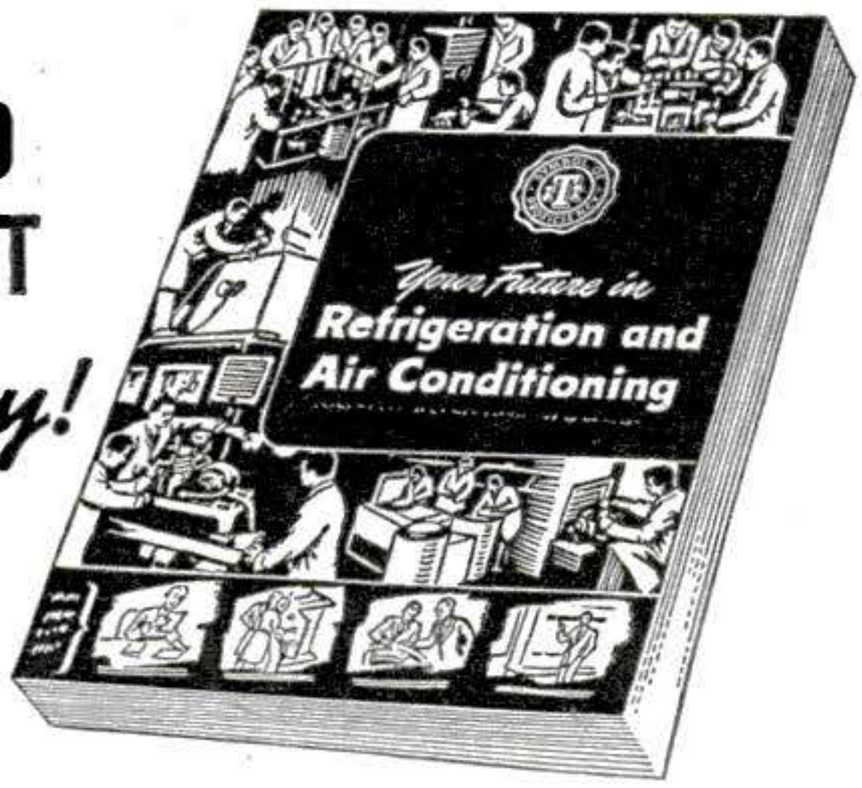

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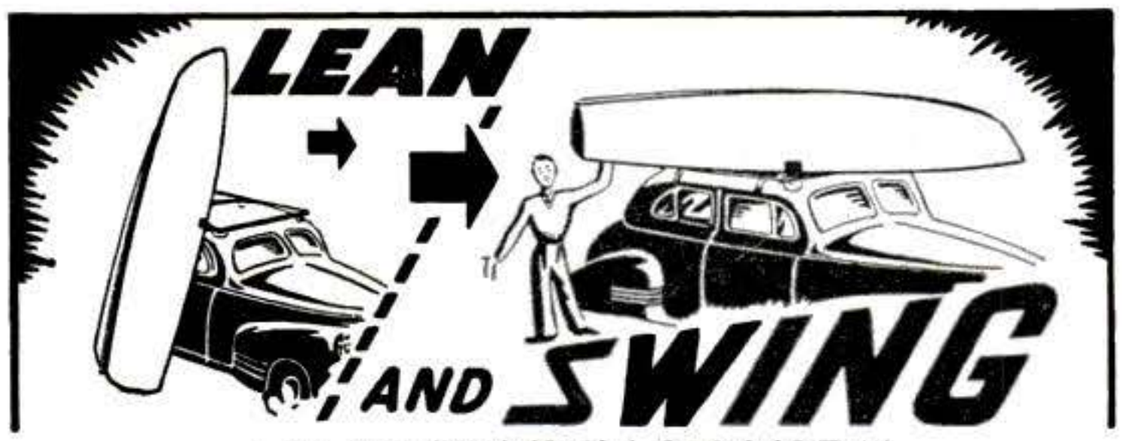

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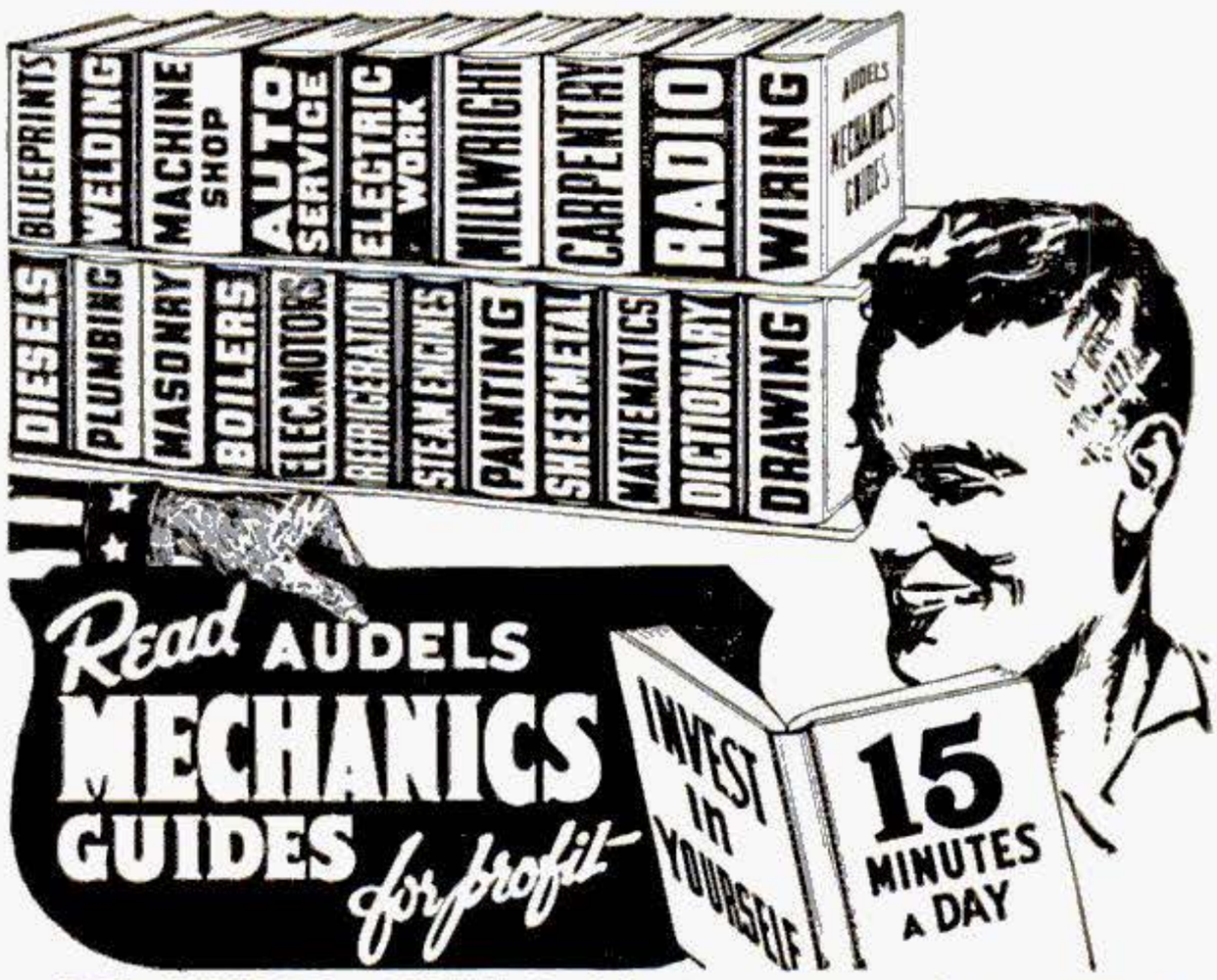

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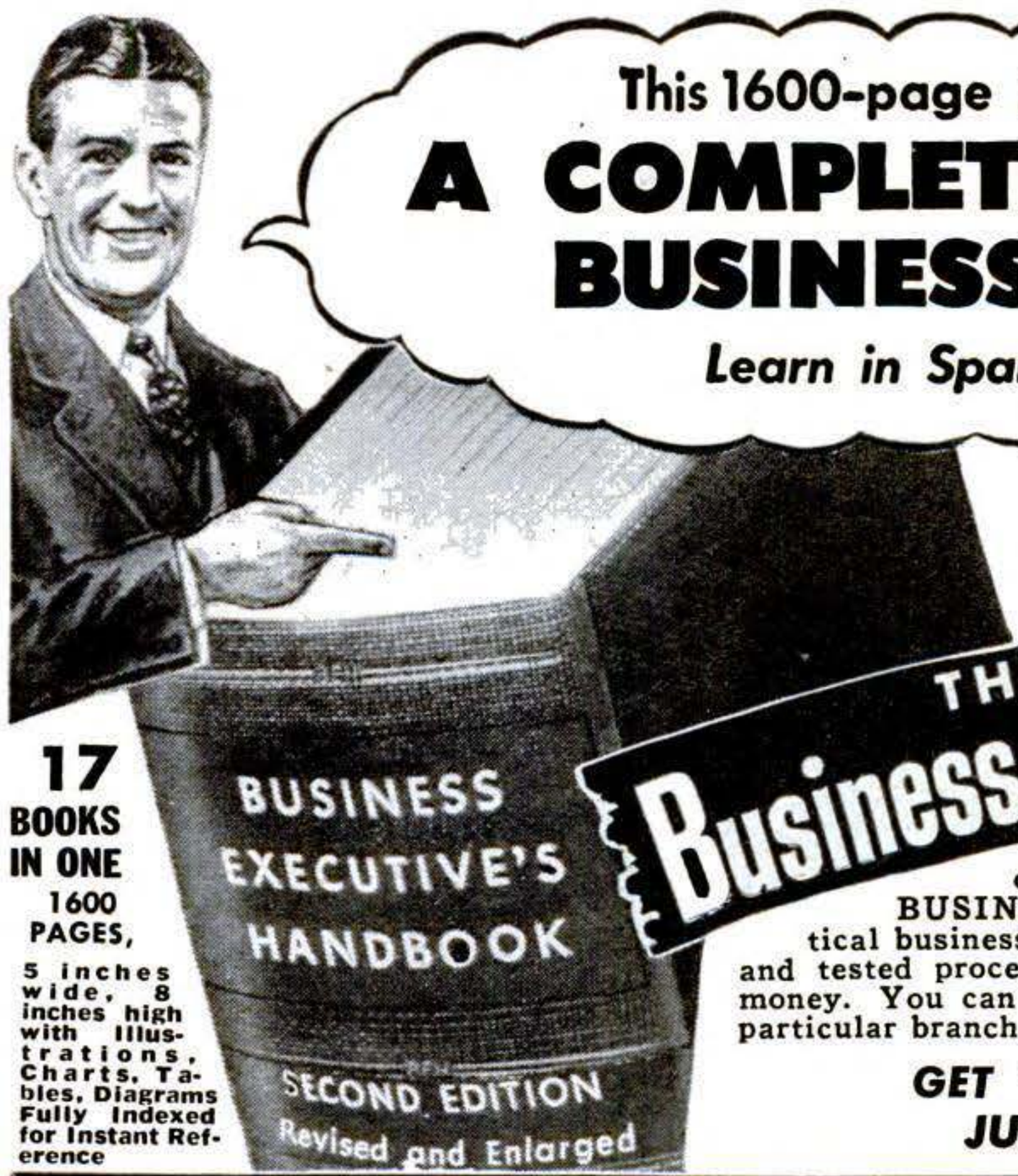

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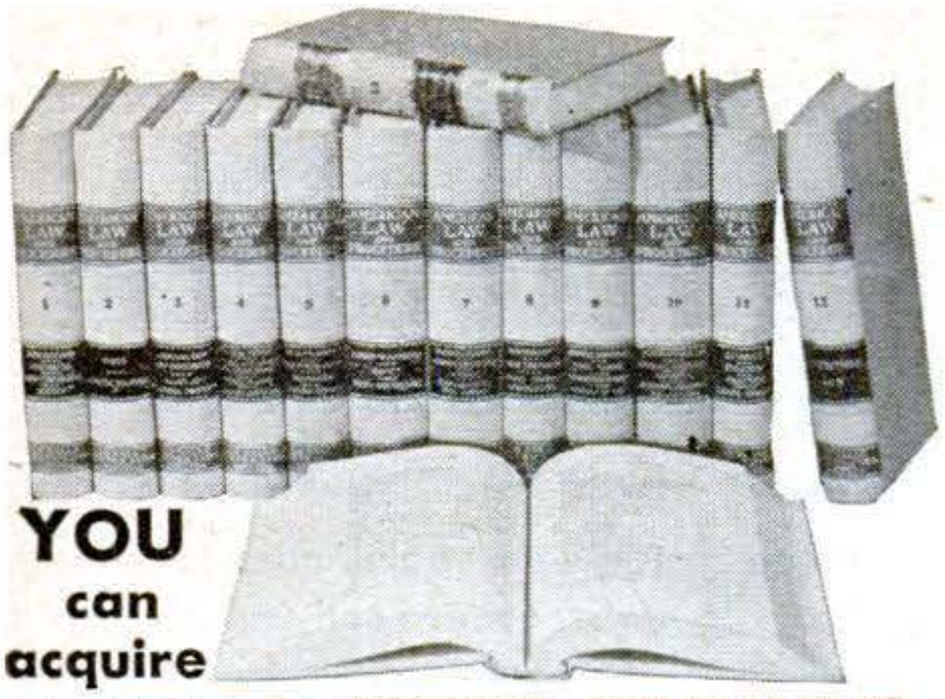

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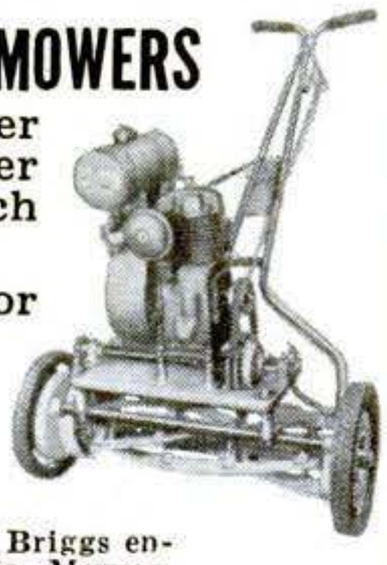

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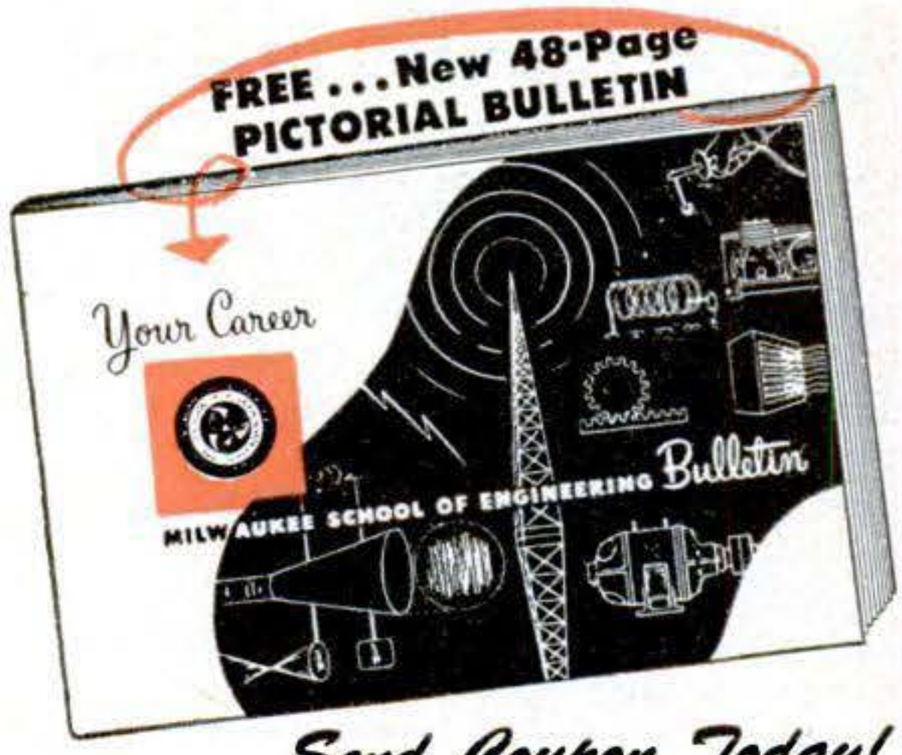

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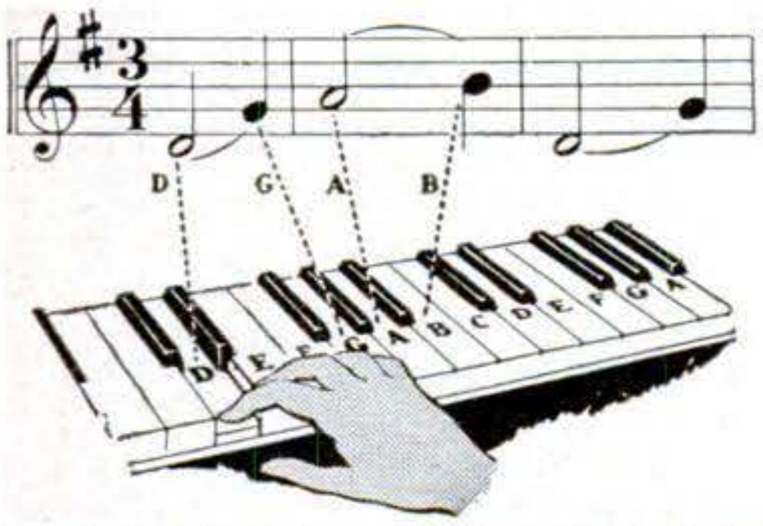

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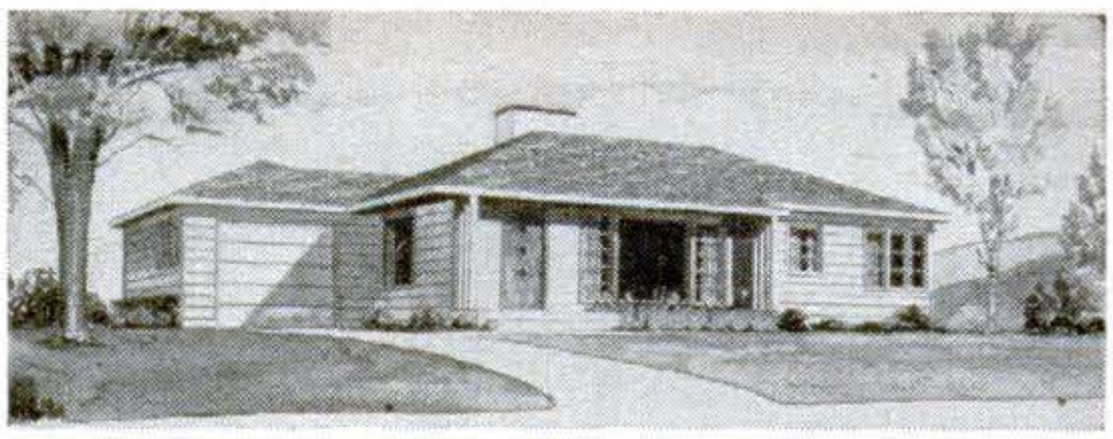

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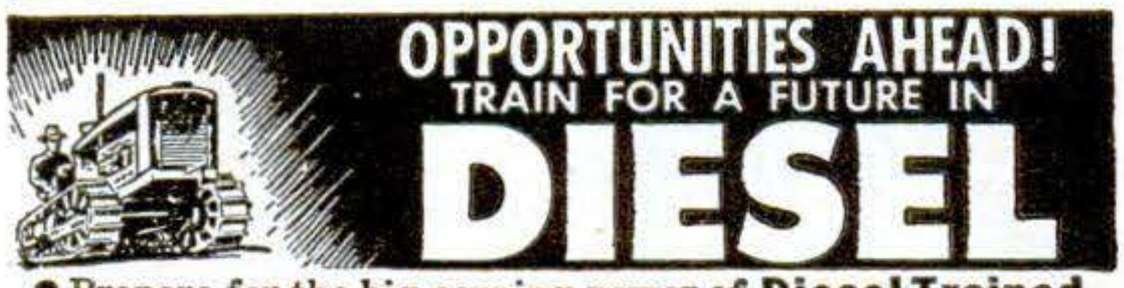

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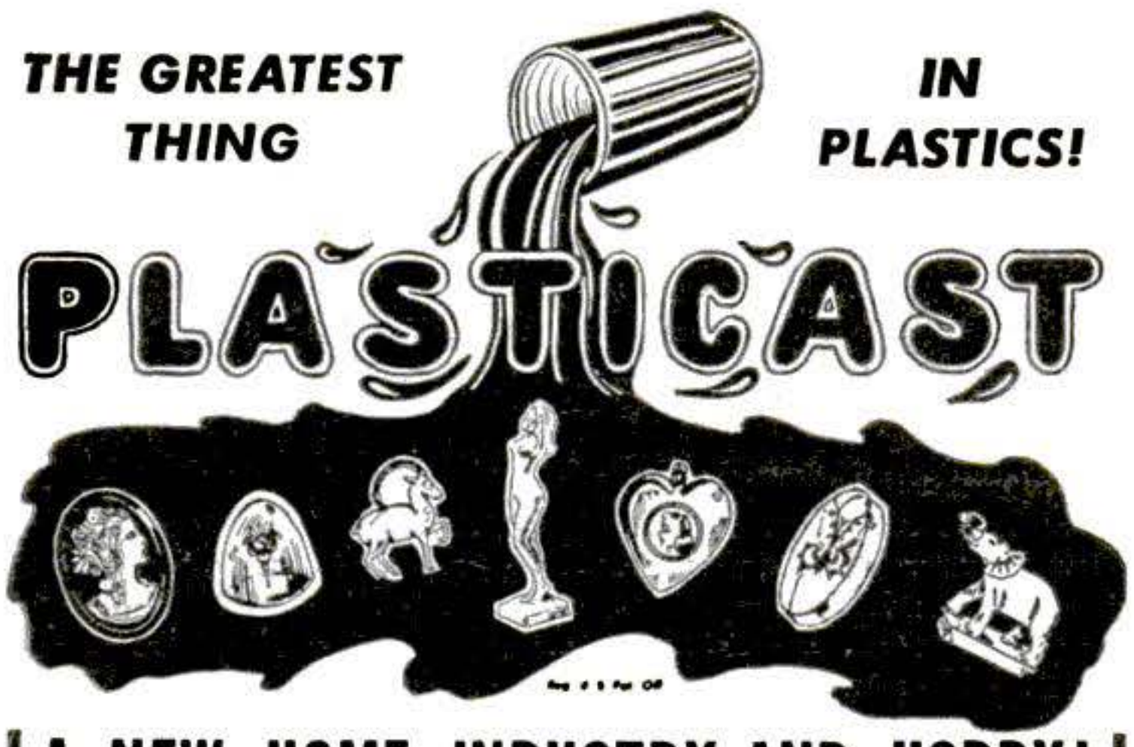

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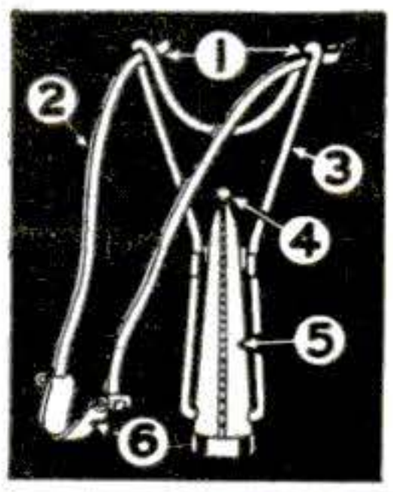

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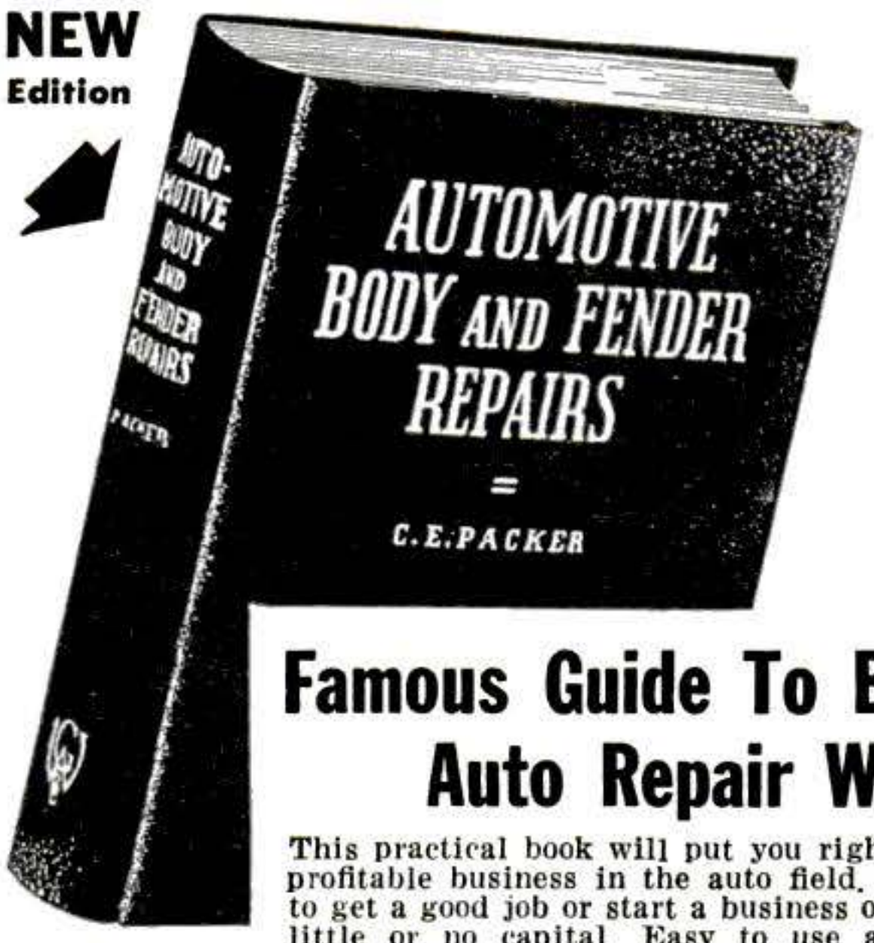

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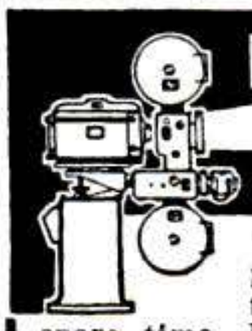

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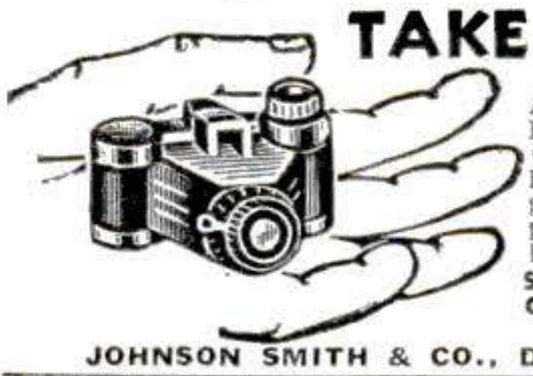

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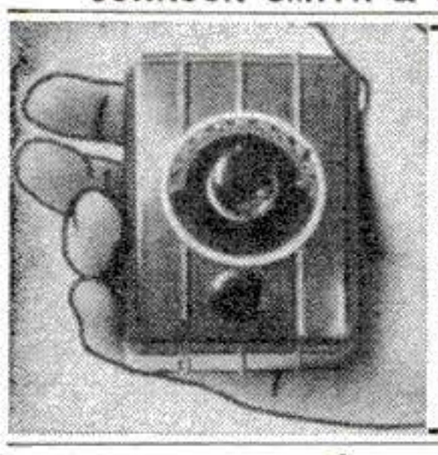

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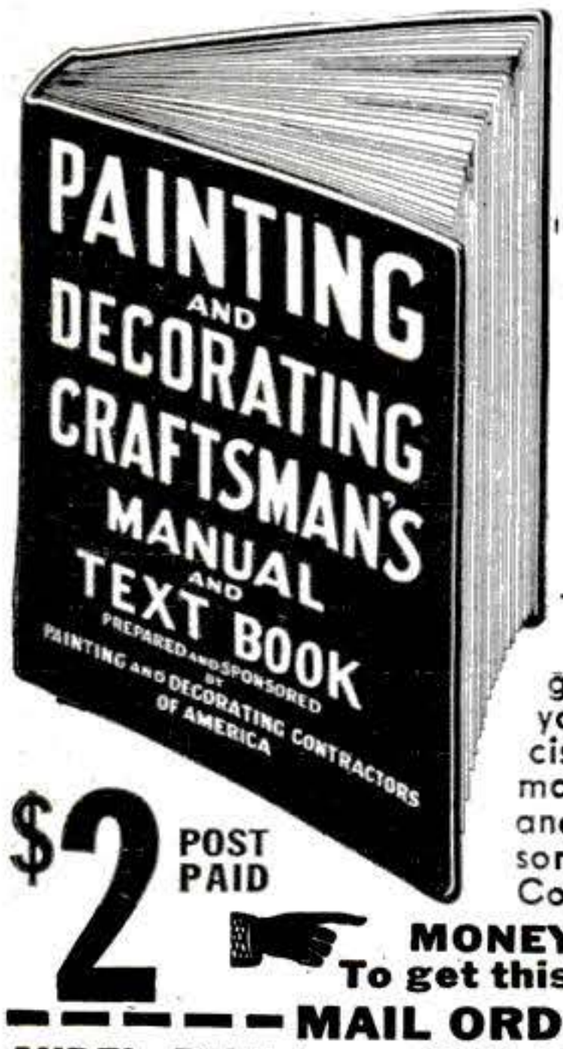

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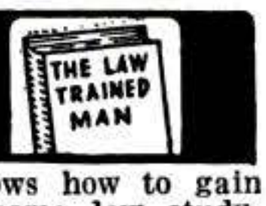

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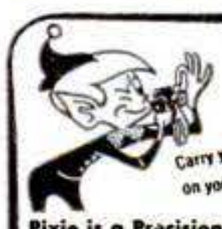

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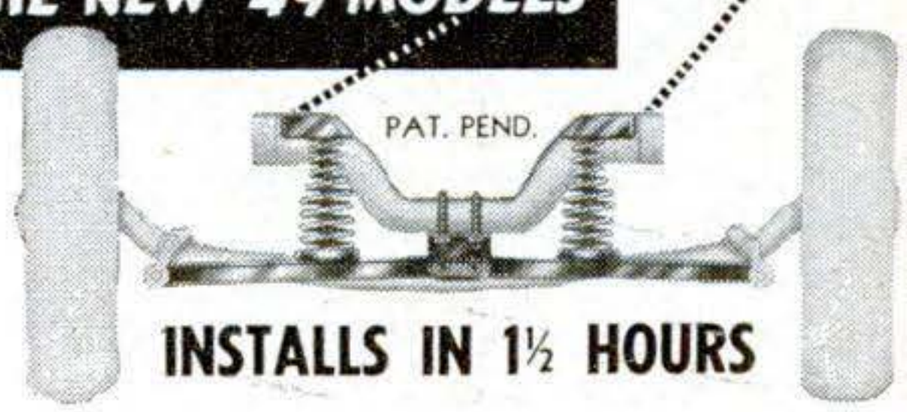

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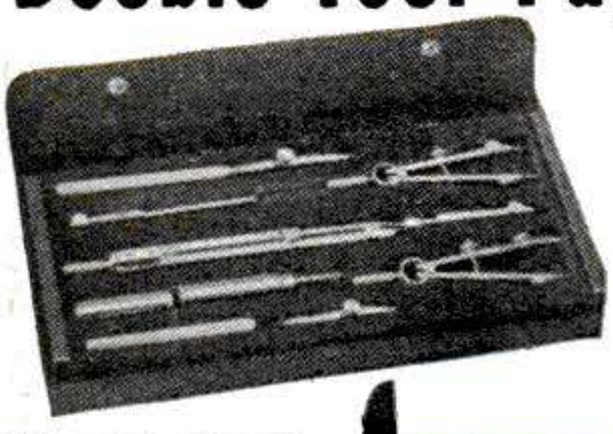

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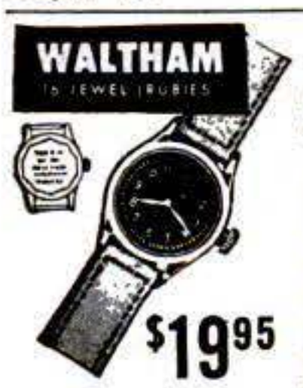

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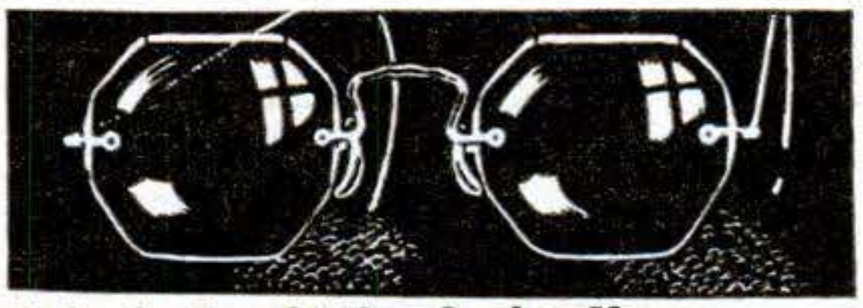

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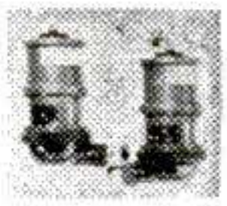

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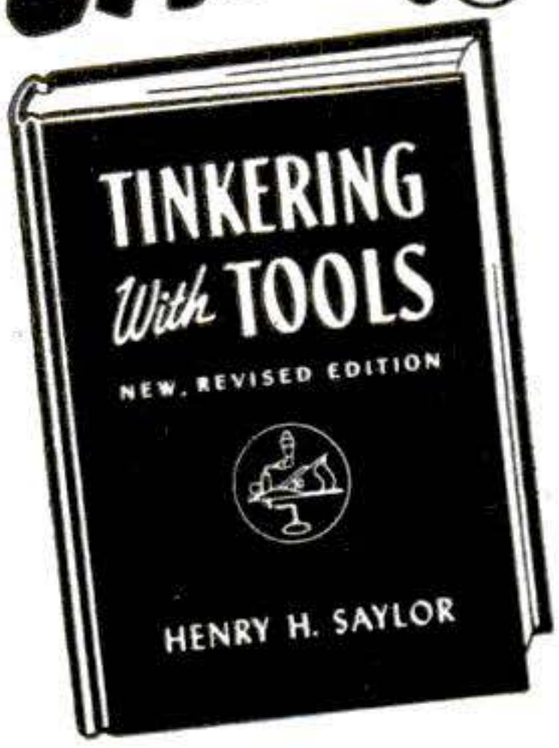

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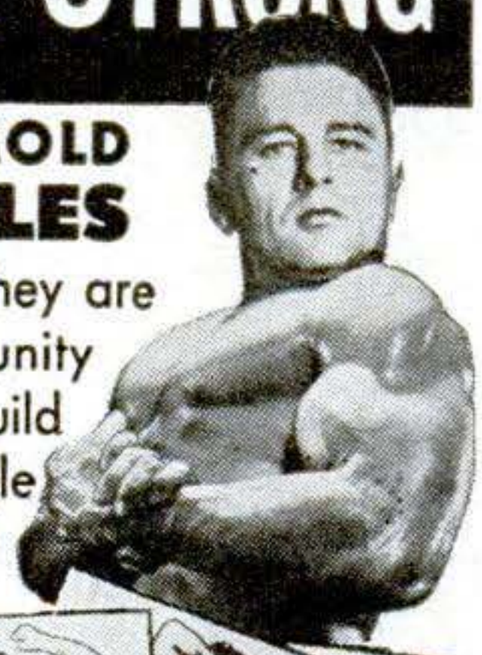

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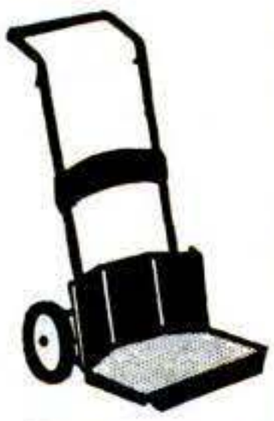

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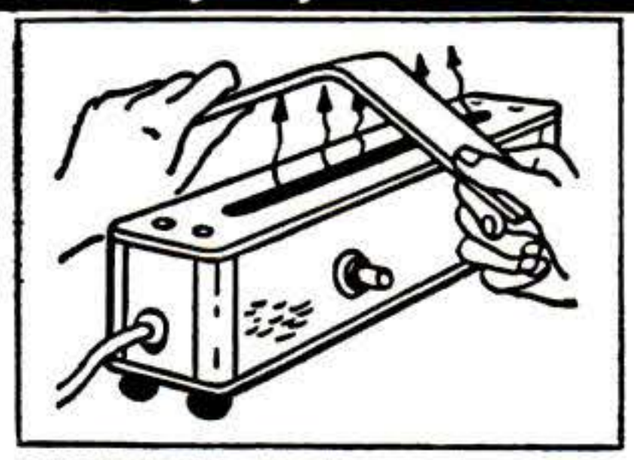

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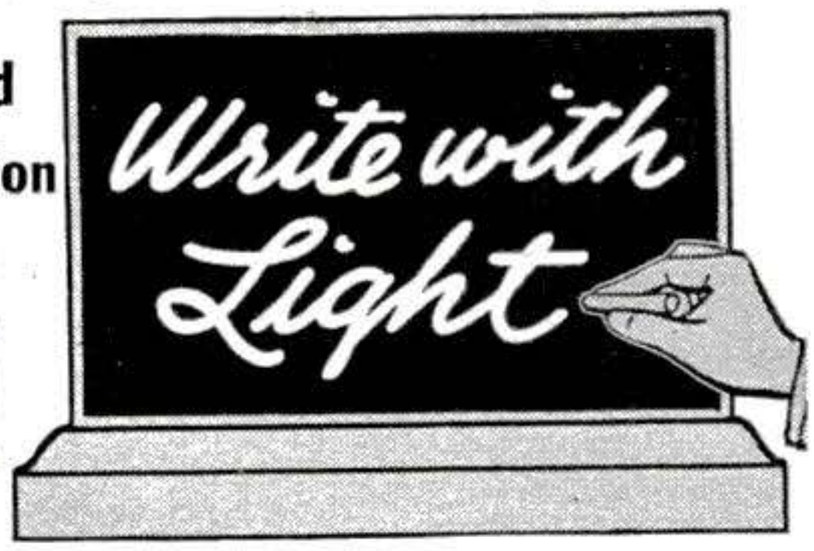

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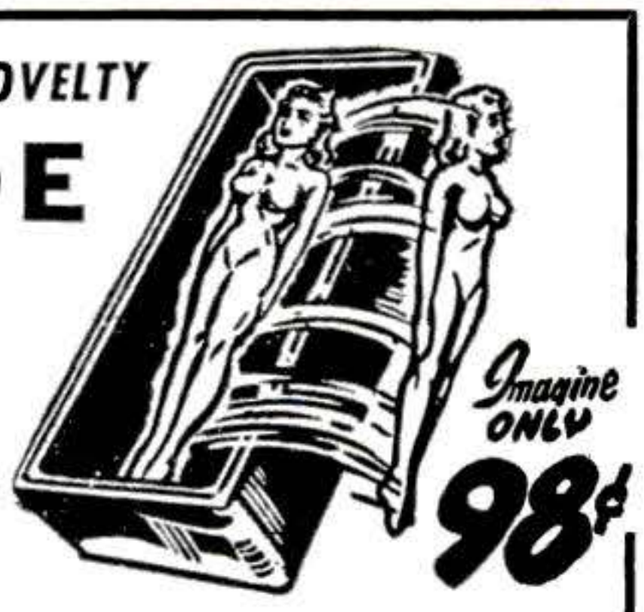

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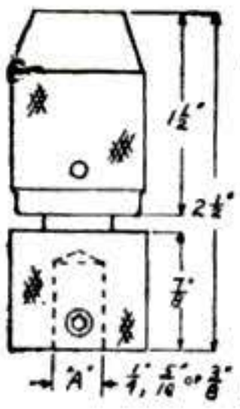

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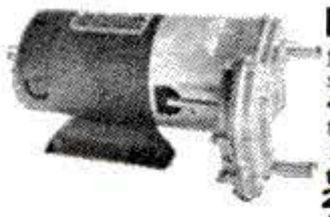

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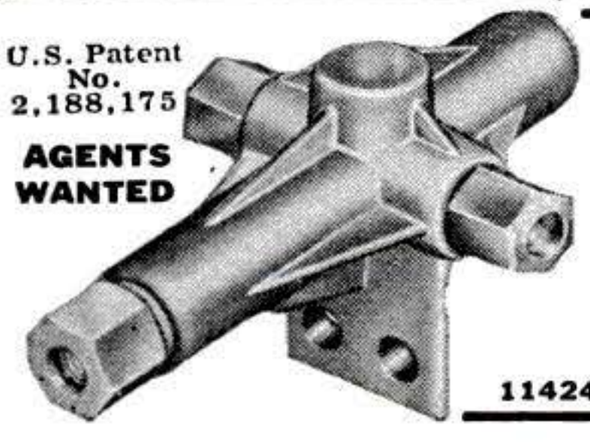

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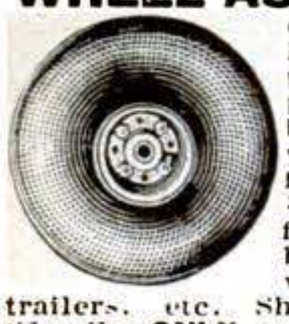

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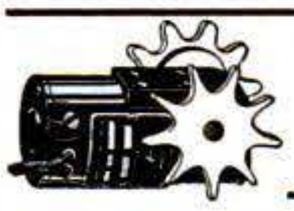

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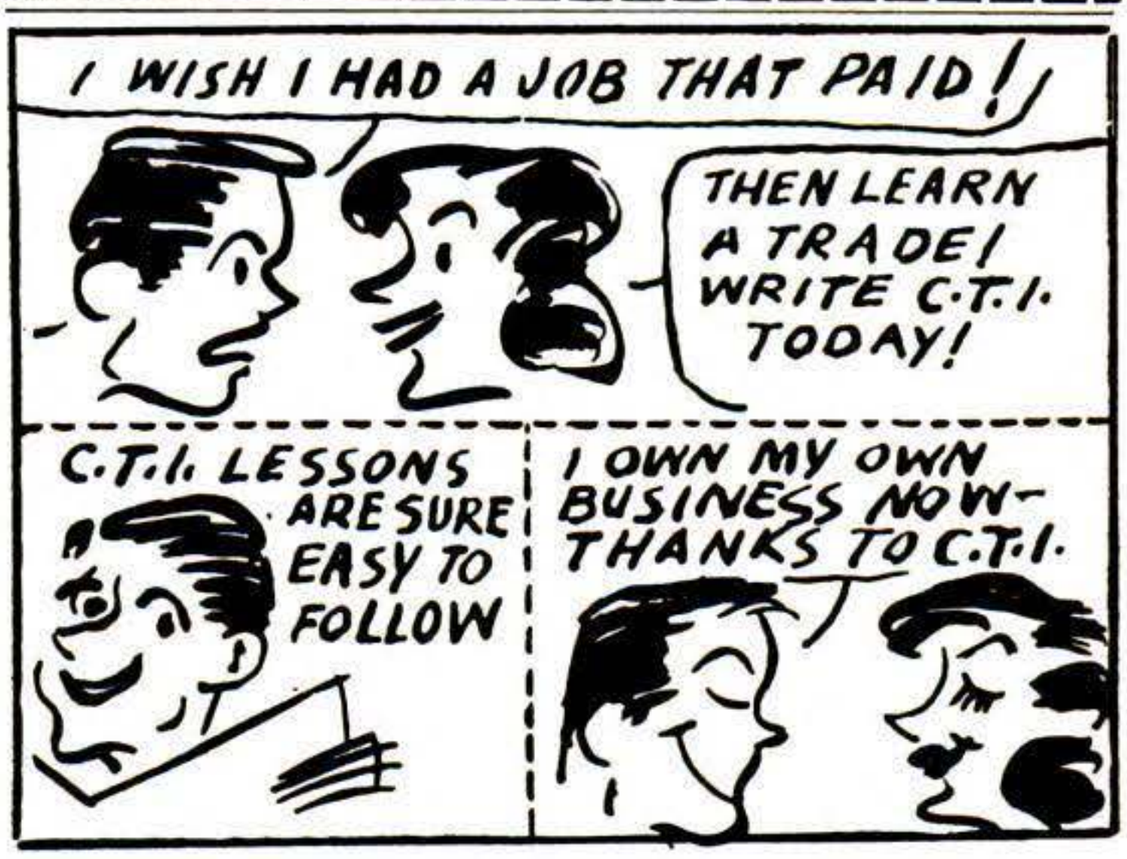

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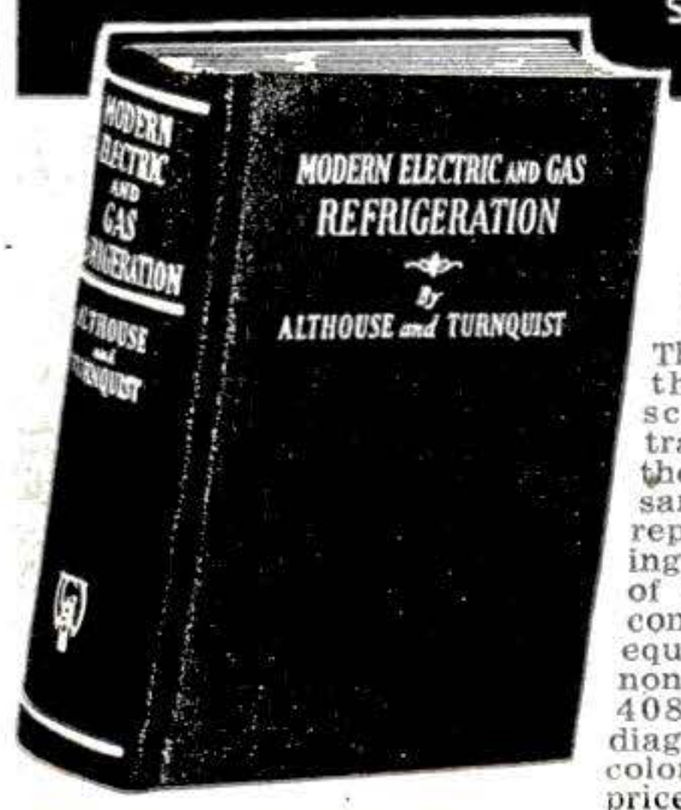

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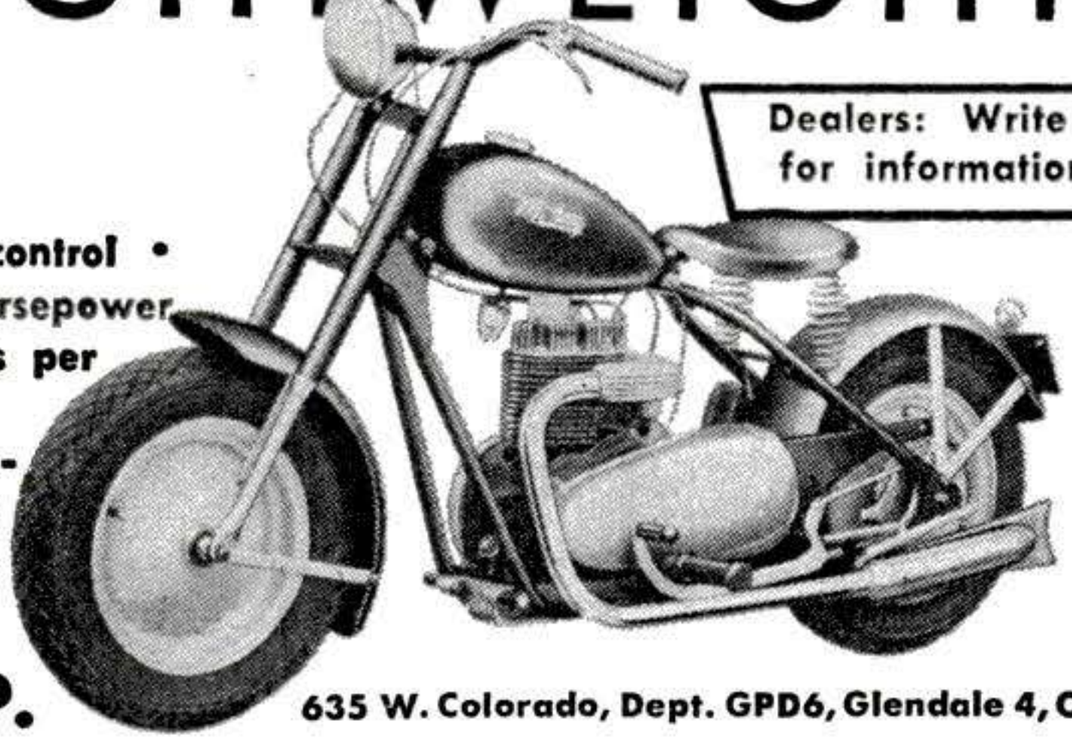

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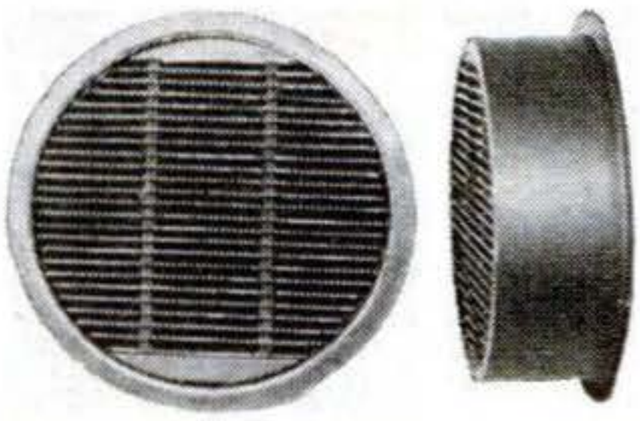

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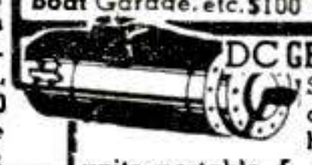

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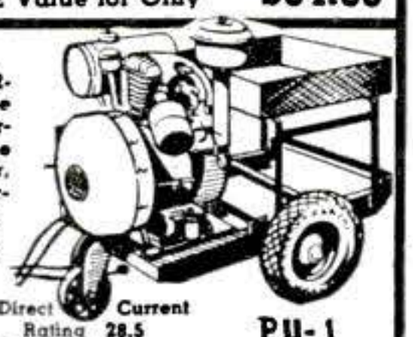

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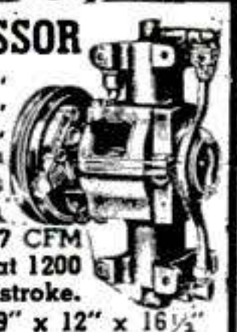

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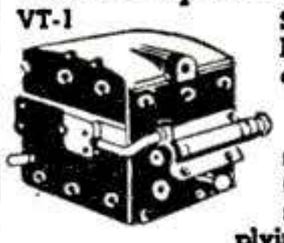

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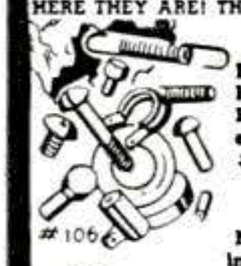

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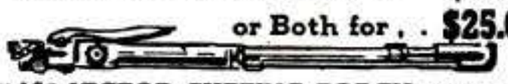

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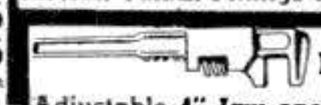

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AGENTS—300% profit selling genuine gold window letters; stores and offices. Free samples. Metallic Letter Co., 437 N. Clark, Chicago.

FREE water and our concentrates make flavors, lotions, shampoos. 125 products. Labels, bottles supplied. Qualco, F-20030 Russell, Detroit.

GOLD lacquered Window Sign Letters. Large Sizes Penny Each. New Foils. Absolutely Beautiful. Free Samples. Atlas, 544 W. 79th, Chicago 20.

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BE renewal headquarters for all magazines. Handle everything at home. Big profits. No experience. No capital needed. Free Catalog tells how. Write McGregor Magazine Agency, Dept. 139, Mount Morris, Ill.

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A DRESS Yours with every 3 you order for yourself and family. Amazing new bonus plan. Everything Free. Harford Frocks, Dept. A-235, Cincinnati, Ohio.

FOAM-O . . . Remarkable cleaning compound. Hospitals, Business, Household, Other. Sample 10c—12 for $1.00. Dealers—Tumbler, Box 1, Islip, New York.

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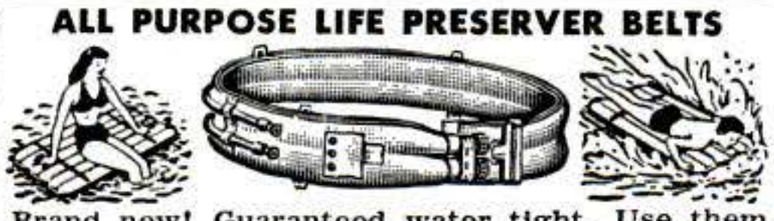

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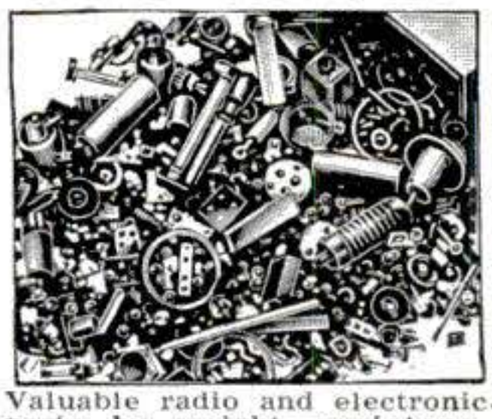

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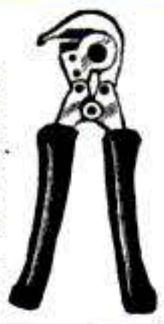

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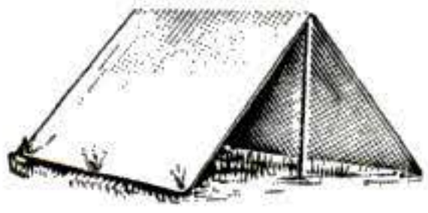

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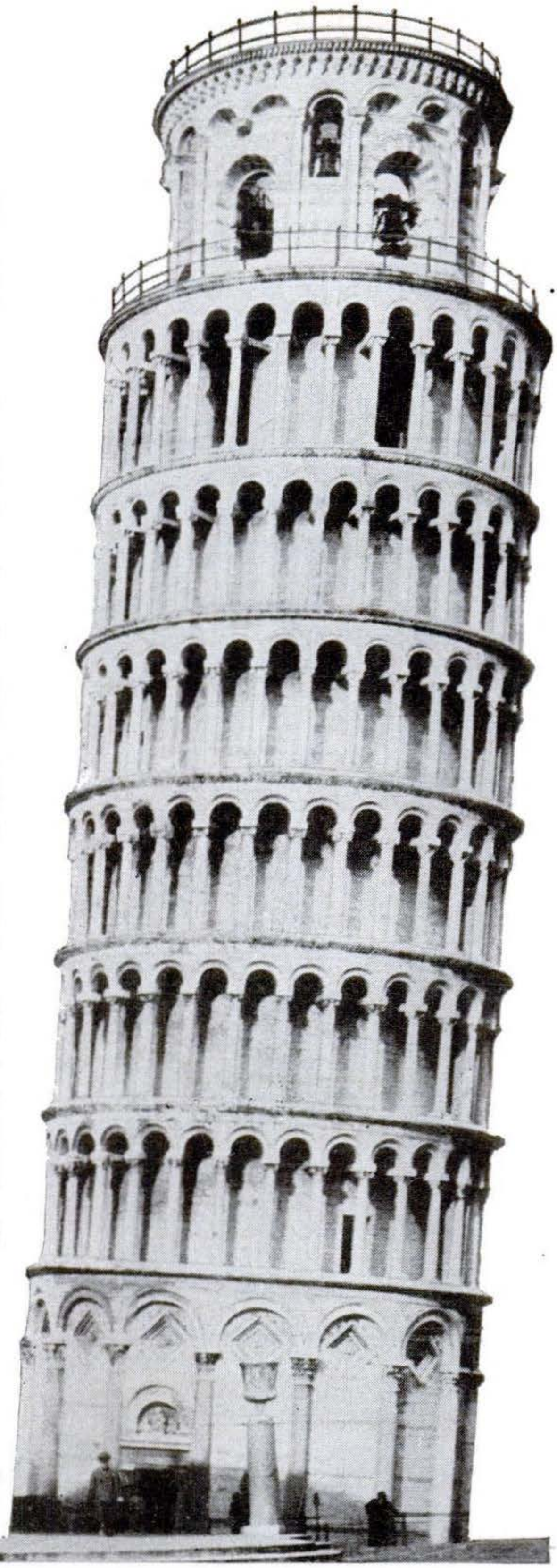

AUTOMATIC SAVING IS SURE SAVING— U. S. SAVINGS BONDS

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Says Man Has Strange Powers That Work While He Sleeps

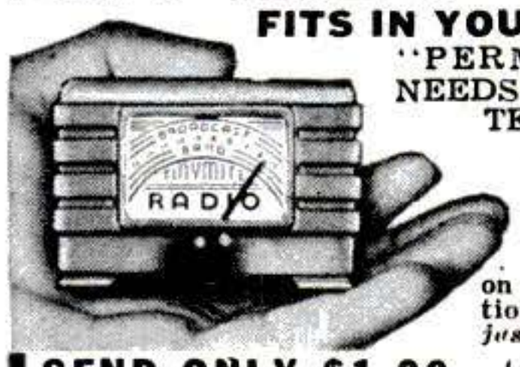
A STRANGE MAN in Los Angeles, known as "The Voice of Two Worlds," reveals the story of a remarkable system that often leads to improvement in power of mind, achievement of brilliant business and professional success and new happiness. Many report improvement in health. Others tell of increased bodily strength, magnetic personality, courage and poise.

The man, a well-known explorer and geographer, tells how he found these strange methods in far-off and mysterious Tibet, often called the land of miracles by the few travelers permitted to visit it. He discloses how he learned rare wisdom and long hidden practices, closely guarded for three thousand years by the sages, which enabled many to perform amazing feats. He maintains that these immense powers are latent in all of us, and that methods for using them are now simplified so that they can be used by almost any person with ordinary intelligence.

He maintains that man, instead of being limited by one-man-power-mind, has within him the mind-power of a thousand men or more as well as the energy-power of the universe which can be used in his daily affairs. He states that this sleeping giant of mind-power, when awakened, can make man capable of surprising accomplishments, from the prolonging of youth to success in many fields. Strangely, he says that this power works best while we sleep, when proper methods are used.

The author states the time has come for this long-hidden system to be disclosed to the Western world, and offers to send his amazing 9000-word treatise which reveals many startling results—to readers of this paper, free of cost or obligation. For your free copy, address the Institute of Mentalphysics, 213 South Hobart Blvd., Dept. K-192, Los Angeles 4, Calif. Readers are urged to write promptly, as only a limited number of the free treatises have been printed.

TINY RADIO—REALLY WORKS



FITS IN YOUR HAND! Works on new "PERMA-CRYSTAL" so it NEVER NEEDS TROUBLESOME TUBES, BATTERIES OR ELECTRIC "PLUG-INS"! Easy to use—Plays for nothing—Should last for years. Beautiful Red Plastic Case.

GUARANTEED TO WORK on local programs by following instructions. C.B. of Ala. says *"Tiny Radio is just Wonderful"!*

SEND ONLY $1.00 (bill, ck, mo) and pay postman $2.99 COD plus postage or send $3.99 for postpaid delivery. SENT COMPLETE READY TO PLAY on simple attachment. Has personal phone. WONDERFUL GIFTS FOR BOYS & GIRLS. Low priced. Order YOUR Tiny Radio Now!

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The Big New Boone AIR TARGET PISTOL

Not a toy but a genuine Target Air Pistol. Sturdy single shot construction with rustless steel barrel and solid aluminum grip. Shoots standard BB shot and is amazingly accurate to 25 feet. 9¾" long overall with open v rear sight. Serrated pistol grip and balanced trigger pull. Modeled after a famous firearm. Single action air cylinder. Positive cocking action. Price includes 150 BB shot. Postpaid if prepaid, or send $1, with $2.95 plus postage COD.

$3.95

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Mows and Trims Lawns

In One Simple Easy Operation 8¼ Lbs.

Save Time and Labor with a

MONTAMOWER

New model. New type metal handle has special device to adjust cutting height. Drive shaft now mounted on free rolling, factory lubricated, sealed ball bearings. No tired backs or aching arms. 8¼ lbs. live precision made mechanism that first gathers, then cuts smoothly a clean 16" swath through grass, dandelions, spike grass, lawn weeds. No noise or clatter. As modern and efficient as your electric razor. Cuts right up to walls, fences, trees or posts; leaves no fringes to be trimmed by hand. Cutters self-sharpening. Built to last many years. Many thousands in use. Sold direct from factory for 26 years. Costs little. Write at once for trial on your own lawn "approval offer," guarantee information and literature.

MONTAMOWER DISTRIBUTING CO.

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Earn Big PROFITS with ARC WELDING

Your Own Shop can earn $350.00, $500.00 monthly

It's easy. Let Hobart help you build a profitable business quickly. Experience not required as welding skill is built in the machine.

New Booklet, "How to Start a Welding Business," tells full story. Send 10c for postage.

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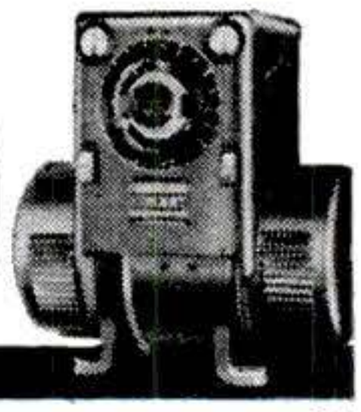
Build Your Own arc welder with this generator and **Save $300.00 to $500.00**



HOBART *"One of the world's largest builders of arc welders"*

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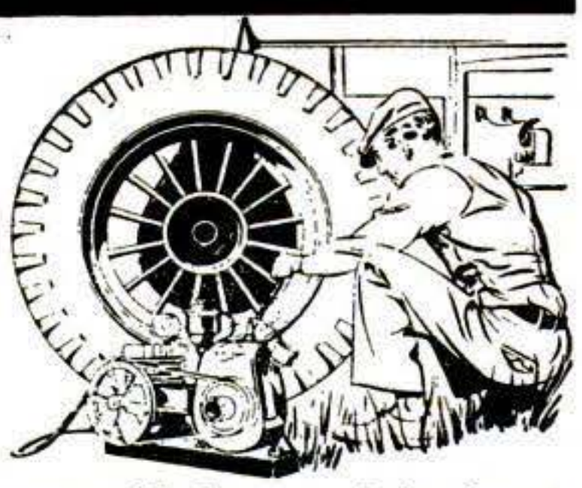
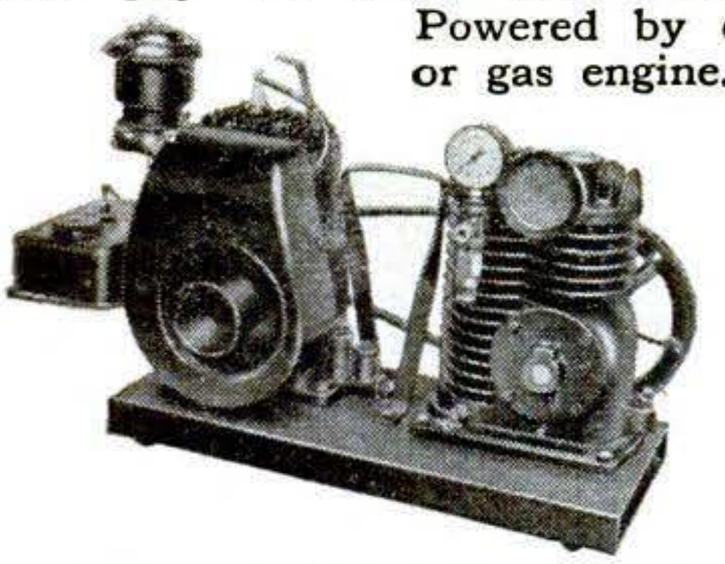
Makes every job EASIER



YOU have never seen a single cylinder portable air compressor that packs so much power as this one. Built by the makers of the famous 4 cylinder Pressure Queen, the Princess will do any job, from inflating tires to painting buildings. Compact, simple and rugged, it will last your lifetime and pay for itself over and over again. Powered by electric motor or gas engine.



Write for Literature and Prices

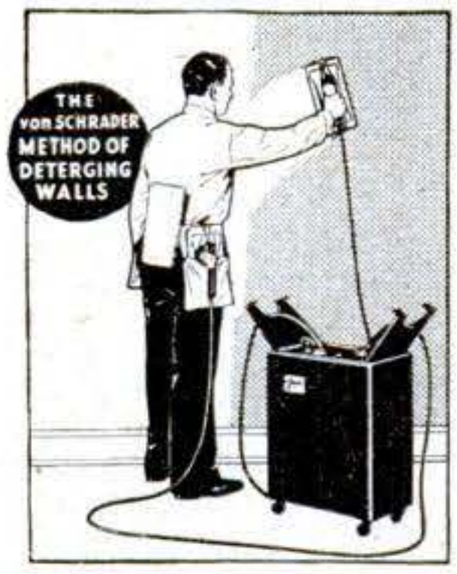
THE CAMPBELL-HAUSFELD CO.

151 Railroad Avenue **Harrison, Ohio**

"TOOK IN $217 FIRST 10 DAYS"

Some Make More, Some Less . . .

We Help You to Start Your Own All-Year Business, Make Big Money!



With our easily operated, highly efficient wall washer, Chas. Stelle took in $217 gross in first ten days. E. L. Goss took in more than $10,000 in one year. E. C. Taber wrote, "I made $400 gross in two weeks." And no wonder—this machine washes walls 6 times **faster** and **better** than by hand.

YOUR MONEY-MAKING OPPORTUNITY

We want more men to go into this profitable business for themselves and enjoy independence. There are customers everywhere—homes, offices, schools, churches, hotels, stores, etc. What you take in is mostly profit, for material costs are low. And there's no need to rent a shop or office. Operate your business from your home.

Lose no time. Get all facts without obligation. WRITE FOR FREE INFORMATION. Ask for Wall Washer Details at once.

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Foredom PRESTO-FLEX with PENCIL-SIZE Handpiece $5.95

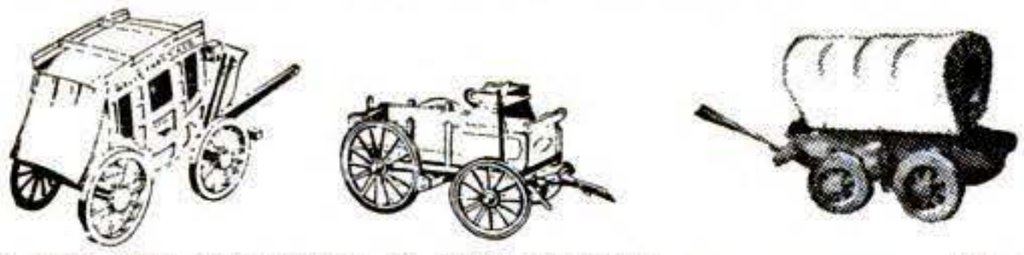
WITH MARVELOUS EASE, you can grind, polish, drill, rout, mill, saw, sharpen, clean, carve, engrave, etch, etc.—on metal, wood, glass, plastic or linoleum. Simply attach to your electric drill, drill press or motor. Presto—a flexible shaft machine! Off again in a jiffy! Pencil-sized handpiece gives finger-tip control. Gets into tight places. Handy 35" overall length. And—only $5.95 complete! ORDER NOW. If you order Presto-Flex for use on motor, specify motor shaft diameter. Add 50c for motor coupling. (Available for 1/4", 5/16", 3/8" and 1/2" shafts.) No. 50 Accessory Set available $1.50 extra.

Finger-Tip Control

Or, order the Foredom Model 99, ONLY **$15.95** complete with universal motor, flexible shaft and pencil-sized handpiece. Write for Catalog E-1019 and see the many Foredoms now available.

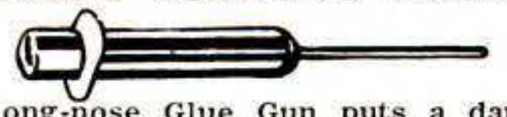
FOREDOM ELECTRIC CO., Dept. E-1019
27 Park Place **New York 7, N. Y.**

BUILD AUTHENTIC "Old West" scale MODELS



It's fun! Try your hand at these famous scale model souvenirs of early settler days. Complete kits with authentic miniature details, precision cut parts, free rolling wheels, formed ribs, leather springs, etc., etc. Order now—save at combination prices.

HANDY BUILDER'S TOOL!



New long-nose Glue Gun puts a daub of cement just where you want it—tight corners, edges, etc. **75c**
Postage 15c (With any kit order, postage free)

Buckboard Kit $1.00
Plus 15c postage

Stage Coach Kit $1.50
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Covered Wagon Kit $1.50
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ALL 3 for Only $3.75
Plus 25c postage

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CRIME DETECTION!

We have taught thousands this exciting, profitable, pleasant profession. Let us teach you **in your own home.** Learn Finger Printing, Firearms Identification, Police Photography, Secret Service Methods thoroughly, quickly, at small cost. Over 800 of all American Bureaus of Identification employ I. A. S. students or graduates. We can prepare you for this fascinating work during spare time. Write today, **stating age,** for "Blue Book of Crime."

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Washes with Suds—rinses with clear water—drys without streaks! Fill plastic head of FOAM RUBBER mop with detergent soap like Vel or Tide, attach hose, regulate water to flow SLOWLY and wash car. Then rinse with clear water. It's quick—it's easy—it's economical!

$2.49 Post Paid
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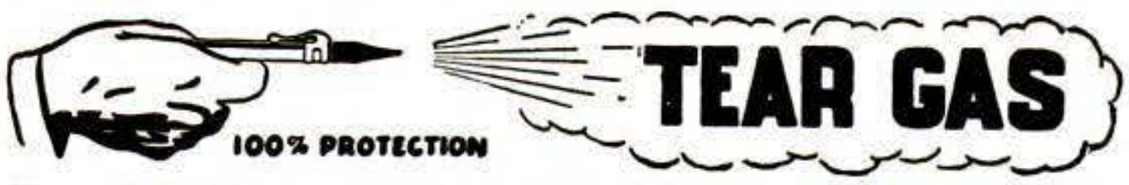

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THUGS AND THIEVES BEWARE!

Here is a tear gas pencil gun which discharges smothering clouds of tear gas to instantly stop, stun and incapacitate the most vicious man or beast. A safe and effective substitute for dangerous firearms. No permanent injury. Needed in Stores, Banks, Autos and Homes, everywhere to protect Life and Property. No skill required. Handle our tear gas as a side line and you'll soon give it full time. For a quick start send $3.60 for complete demonstrator outfit consisting of an Automatic Pencil Gun with 10 demonstrators and 3 powerful Tear Gas cartridges fully guaranteed. Many thousands now in use. Order your outfit today. Not sold to minors.

Hagen Supply Corp. **Dept. P-507** **St. Paul 4, Minn.**

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Flash Your Turns

New Model SIMPLEX DIRECTION SIGNAL KIT fits most cars. Gives new safety and comfort when making turns. Eliminates arm signals. Flashing parking and tail lights show other cars which way you're going to turn. Flashes 60 to 80 times a minute. Works like factory installed models on expensive cars. Does not interfere with operation of present lights. Install it yourself. All parts furnished. For most 1942 to 1949 cars. SPECIFY MAKE AND YEAR. Adaptable to earlier cars at extra cost. MONEY BACK GUARANTEE.

$8.95 Postpaid in U.S. Send check or money order. Postage extra on C.O.D.'s.

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Thompson BEATS the World on BOATS

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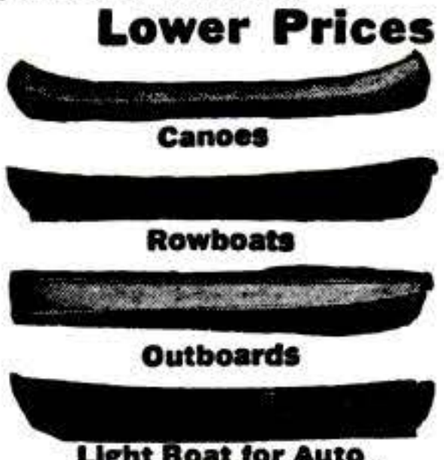

Safe Boats With Full Length Spray Rails

Keep passengers perfectly dry—even at high speeds. Catalog also shows two new models of "Take-Along" Boats. Two big factories—save you freight.

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Write for your copy. State kind of boat in which you are interested.

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The new wonder animals from Syria. Often called Toy Bears. Delightful pets. Everyone wants them. Laboratories need thousands. Clean, odorless. Raise anywhere. A profitable and interesting hobby or business. We furnish breeders and instructions. Write today for free book.

GULF HAMSTERY, 1540 BASIL ST., MOBILE, ALA.

750' 2-PLY NYLON 25 lb. T
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300' SILK LINE 30 lb. T
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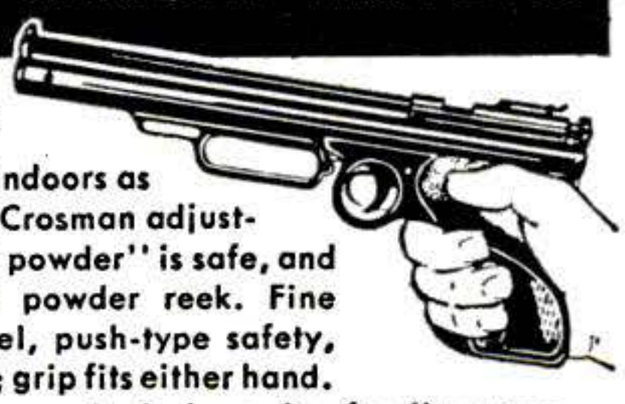
BRAIDED NYLON LINE

200'	20 lb.	Test
175'	35 lb.	Test
150'	50 lb.	Test
125'	75 lb.	Test
100'	100 lb.	Test
50'	200 lb.	Test

110 ft. Nylon Drop Line, 100 lb. Test—50c
Pachner & Koller Liteweight Fly Reel $1.00
All lines available in longer lengths. Send Check, Money Order.

MAC-MILLS Dept. L-7 Pleasant Valley, New York, N. Y.

Crosman TARGET PISTOLS



.177 or .22 Cal.

NOW you can shoot indoors as well as outdoors, for Crosman adjustable "power without powder" is safe, and there's no noise or powder reek. Fine balance, rifled barrel, push-type safety, adjustable rear sight; grip fits either hand. Only $14.95! At your dealer's; write for literature.

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Low FACTORY-TO-YOU *Prices*

New! MIDWEST TELEVISION

with BIG **75 Square Inch SCREEN**

- **12½" PICTURE TUBE**
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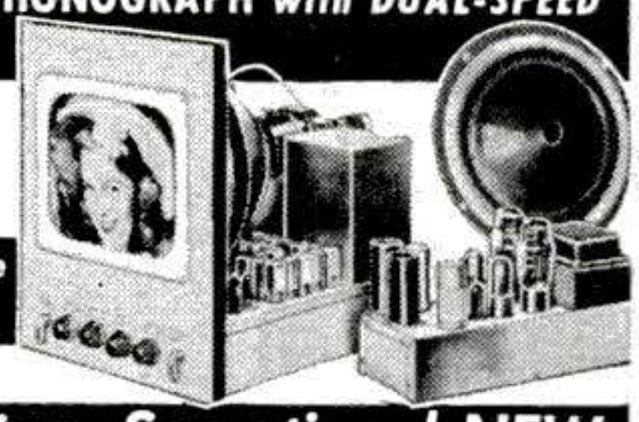
- **PICTURE-HOLD CONTROL**

30 DAYS TRIAL - *EASY TERMS!*

Other Models Include: **SYMPHONY GRAND AM-FM RADIO-TELEVISION-PHONOGRAPH *with DUAL-SPEED* RECORD PLAYER**



Also complete CHASSIS for Custom Installation—and Adapter Chassis and Consolette for use with 1947, 1948, 1949 Midwest Radio Models.

Factory Authorized Service in all Television Areas

Also— Sensational NEW **MIDWEST RADIOS** *with* **DUAL-SPEED Phonograph**

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Here's an outstanding manufacturing opportunity for men with vision, energy and a little capital. Brikcrete is sweeping the country because it has beauty, long life and ultra comfort. Truly the world's most modern masonry. Distinctively different. Yet costs less than lumber because it is locally manufactured of local materials by local labor for local building needs.

100%-150% Mark-Up on Costs

You can be one of a national chain of local plants. High income potentials. Can be started on moderate investment. Wide-open market. Requires no experience; no skilled labor. We supply all equipment. Easy terms, if necessary. We work with you to put it over. Write for Brikcrete Book No. 2 and tentative reservation of territory.

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(10% discount on 2 or more tires if you send this ad with order)

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GOLD BOND GUARANTEE FOR 12 MONTHS

550-16	$3.54	550-15	$3.79	450-21	$5.14
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700-20 (8)	9.29	1100-20	13.89	900-16	8.98
700-20 (10)	12.48	1200-20	18.78	825-15 (14 ply)	14.10
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512 NORTH 1ST ST., RICHMOND, VA.

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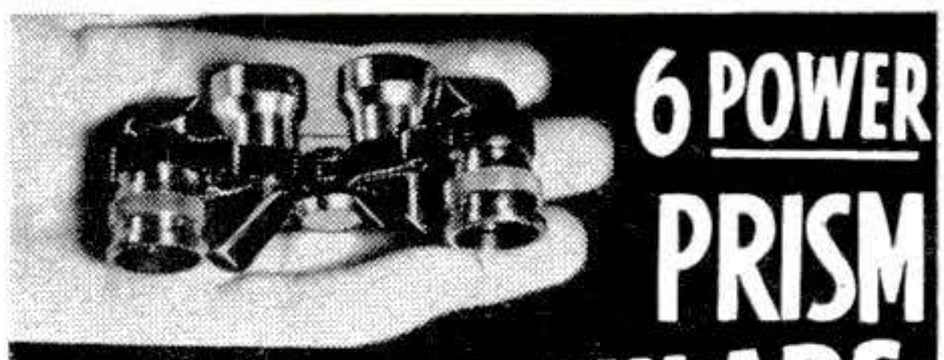

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IT'S AUTOMATIC

Sets hand saw teeth in 60 seconds—Approx. 400 band saw teeth. 4½ to 12 points with one adjustment. Hammer and anvil action does precision job. Every tooth alike—no breakage.

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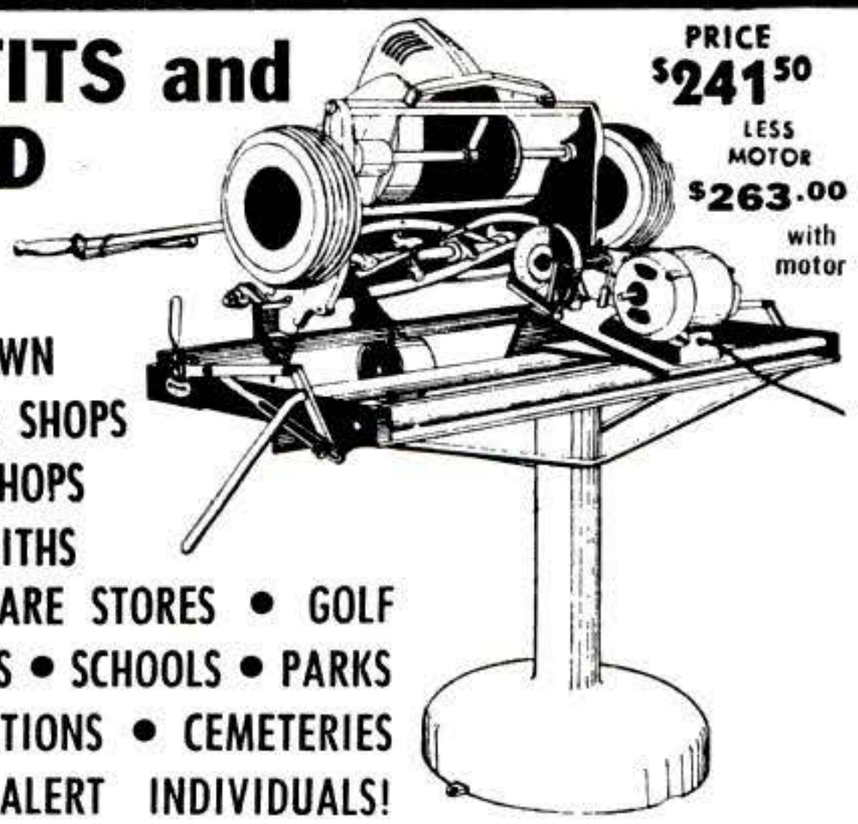
MODERN LAWN MOWER SHARPENER

PROFITS and SPEED



PRICE $241.50 LESS MOTOR $263.00 with motor

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Sharpens All Reel Type Mowers • Hand, Power or Gang • 10 to 20 Minutes • No Dismantling No Extra Attachments Needed

All reel type mowers, from 5-inch edgers to 36-inch power mowers, are quickly sharpened to extreme ends of both left and right twist reel blades. Handle, wheels, roller and motor remain in place when sharpening is in process. Bed knife is sharpened in same brackets that hold mower in grinding position. No extra attachments required. One lever puts mower or bed knife in grinding position. 100% steel construction. Grinding head rides on five ball bearing races. Easy to operate. Sharpens wood chisels, joiner knives and planer blades without extra attachments.

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Install ADJUSTABLE TAPPETS

for FORD and MERCURY V-8's (85-100 HP)

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"I'm buying another Crosley because it's the easiest way to save money," says Mr. Albert E. Wallace, Covington, Kentucky. "My Crosley took me over 20,000 miles without a repair bill. And 40 miles on a gallon of gasoline means money in the bank".

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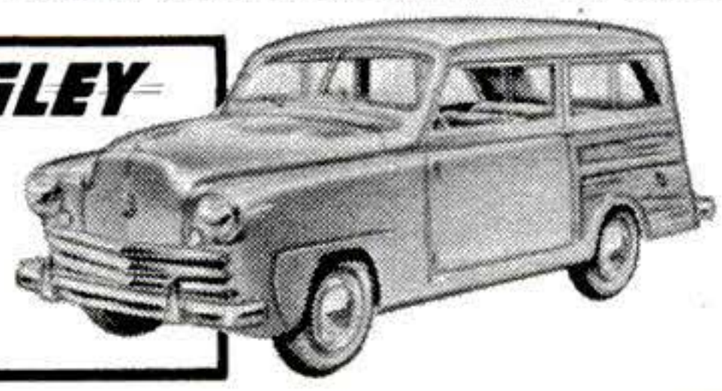
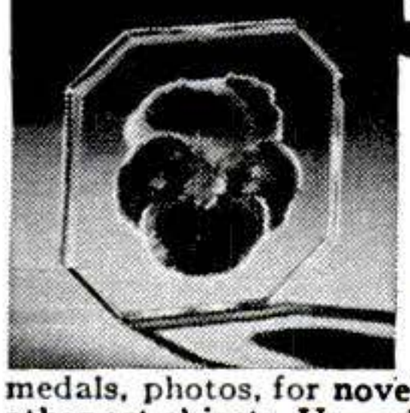
CROSLEY *a* FINE *car*



Plastic Coasters and Tiles

EMBED REAL FLOWERS in *NEW* Magic PLASTIC



Now create many lovely and unusual things like the distinctive pansy coaster shown—made by embedding real pansies in Castolite—the "magic" liquid casting plastic. Comes crystal clear, or may be dyed to produce gorgeous color effects. Make really different jewelry, book ends, picture frames, candle sticks, figurines. Embed butterflies, coins, medals, photos, for novel plaques, paper weights, tiles, other art objects. Use only home utensils. Follow simple step by step method. New pleasure, fine profits are possible. Send 25c for exciting new Home Project Manual showing how to get started. *Write today!* **The Castolite Company, Dept. H-4, Woodstock, Ill.**

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You Need NO Additional Parts

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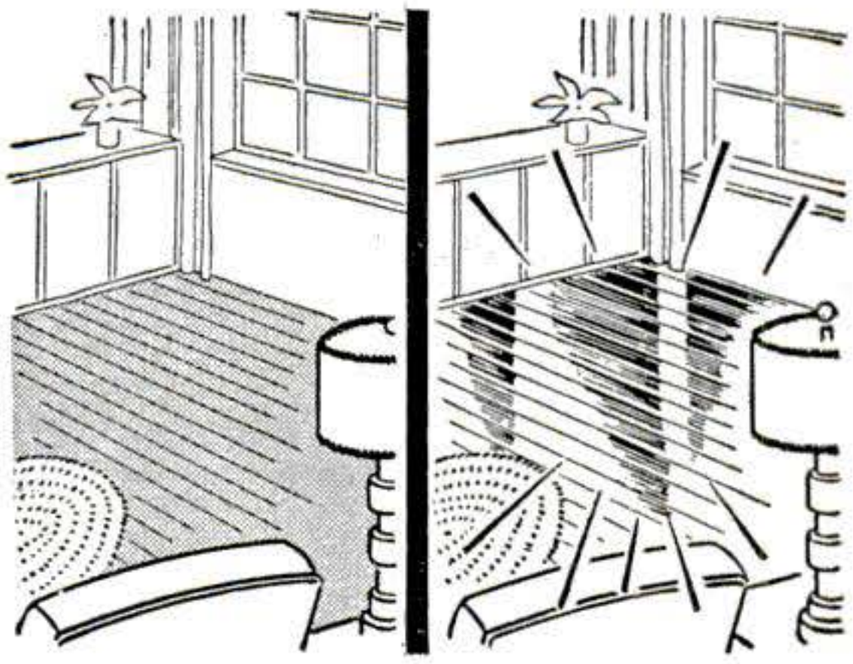

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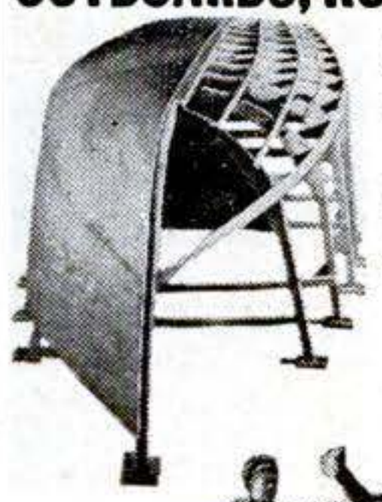

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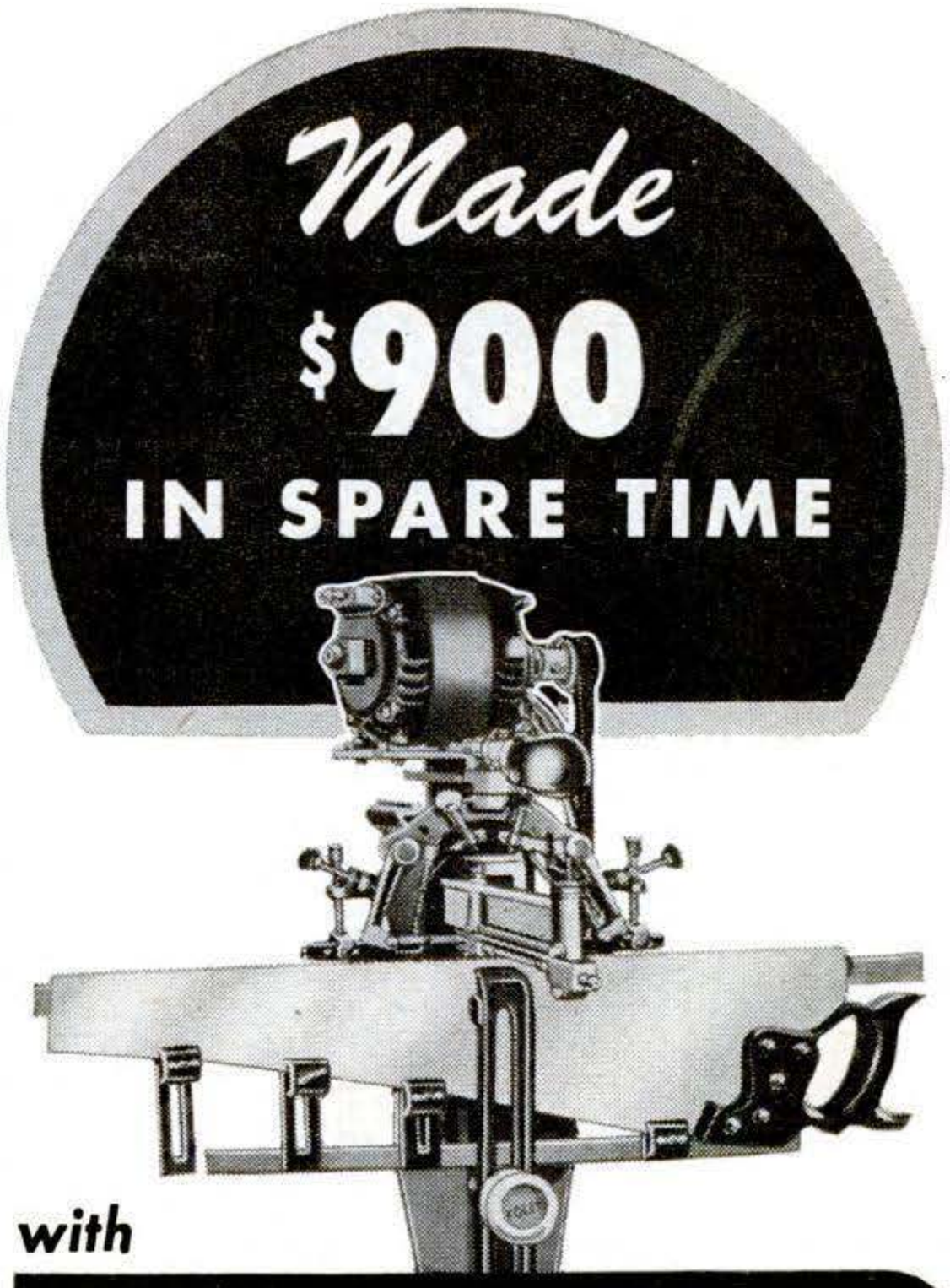

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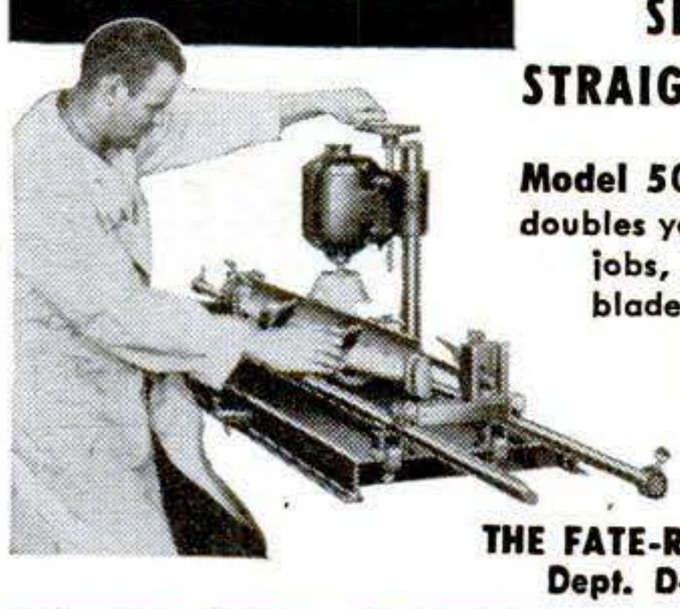

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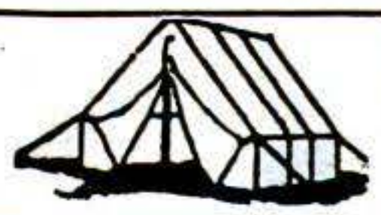

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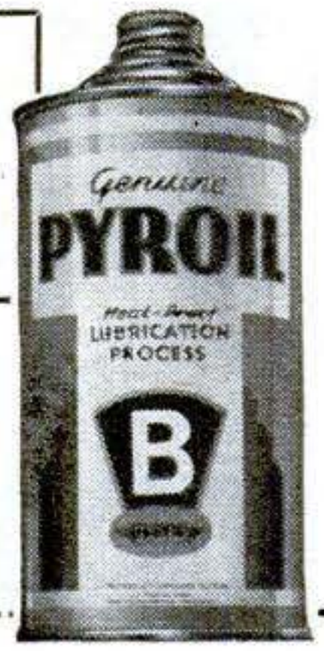

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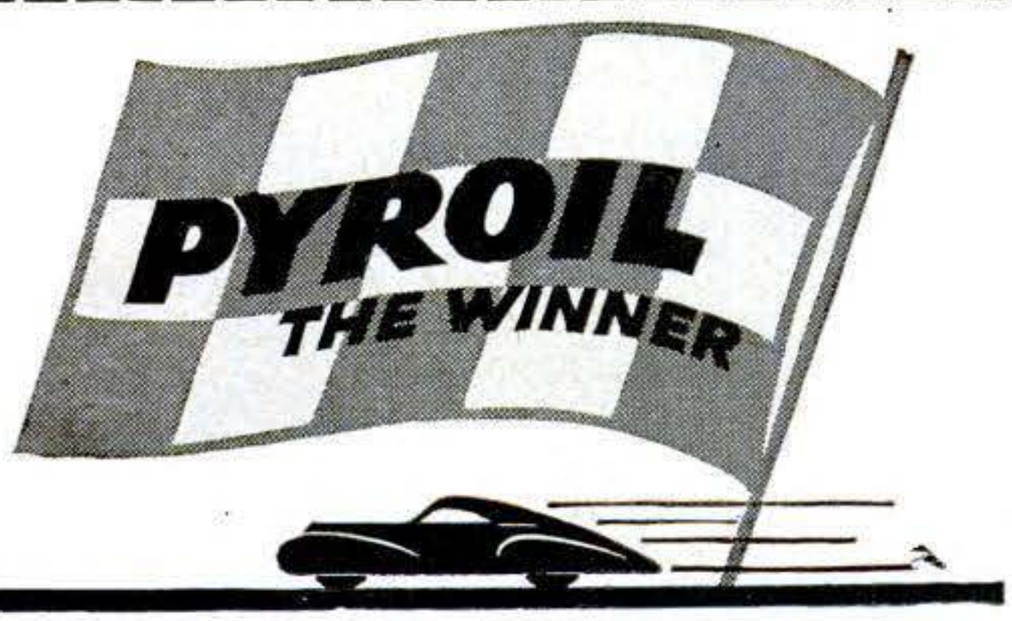

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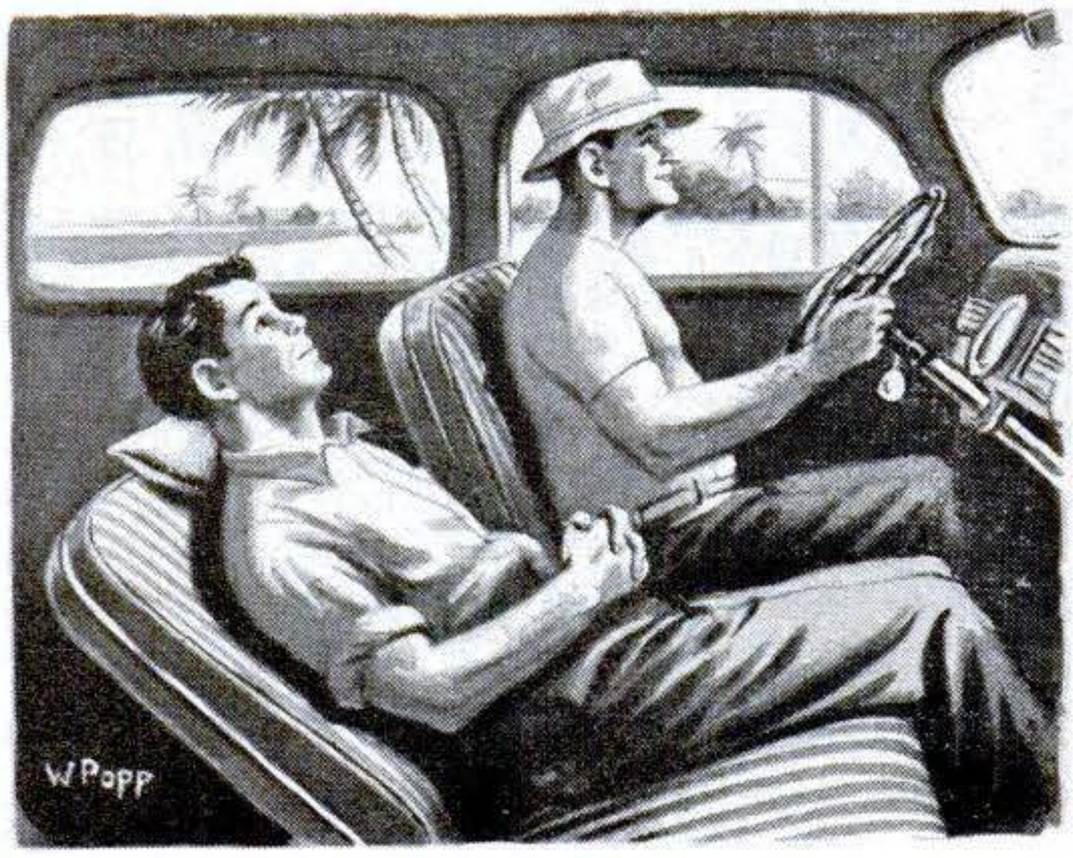
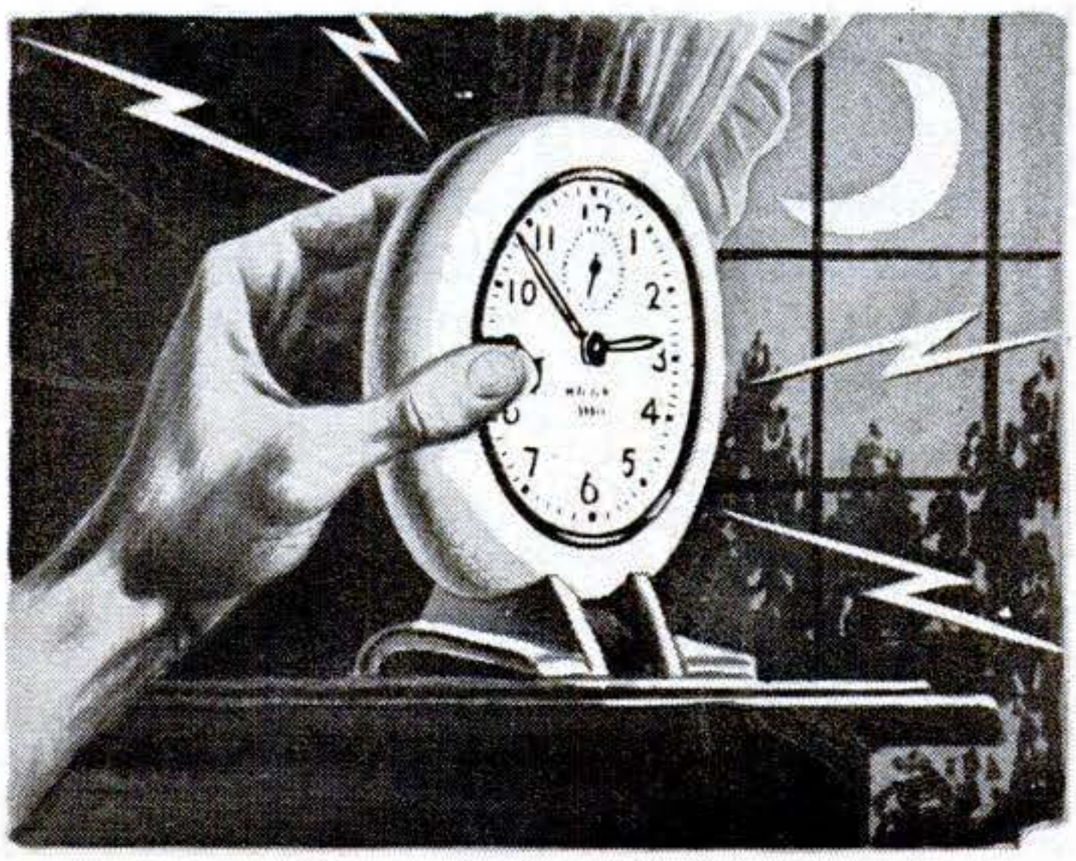
Everybody has his own pet idea of some gadget he would like to see in general use. What is YOURS? *Popular Science* will pay $5.00 for each one published. Use government postcards only. Contributions cannot be acknowledged or returned.



Reclining right front seats in autos. If these were adjustable, as are seats in trains and buses, a passenger could relax much more comfortably during long trips, or even get some sleep.—*Harold Frankel, Louisville, Ky.*



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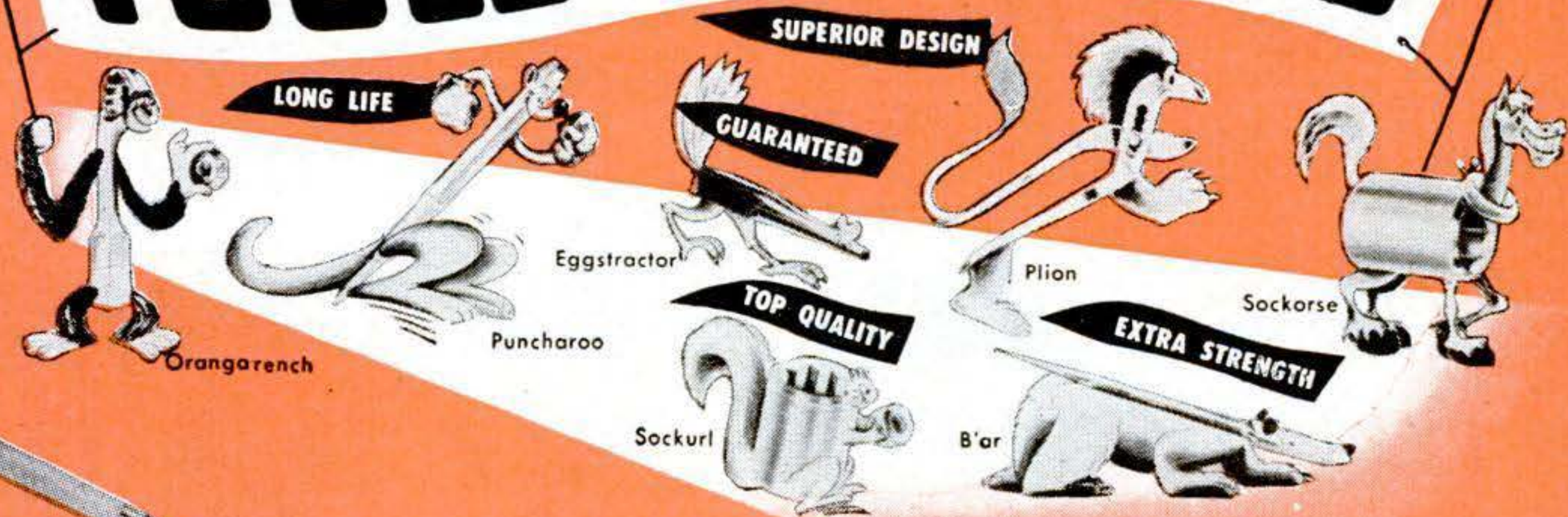

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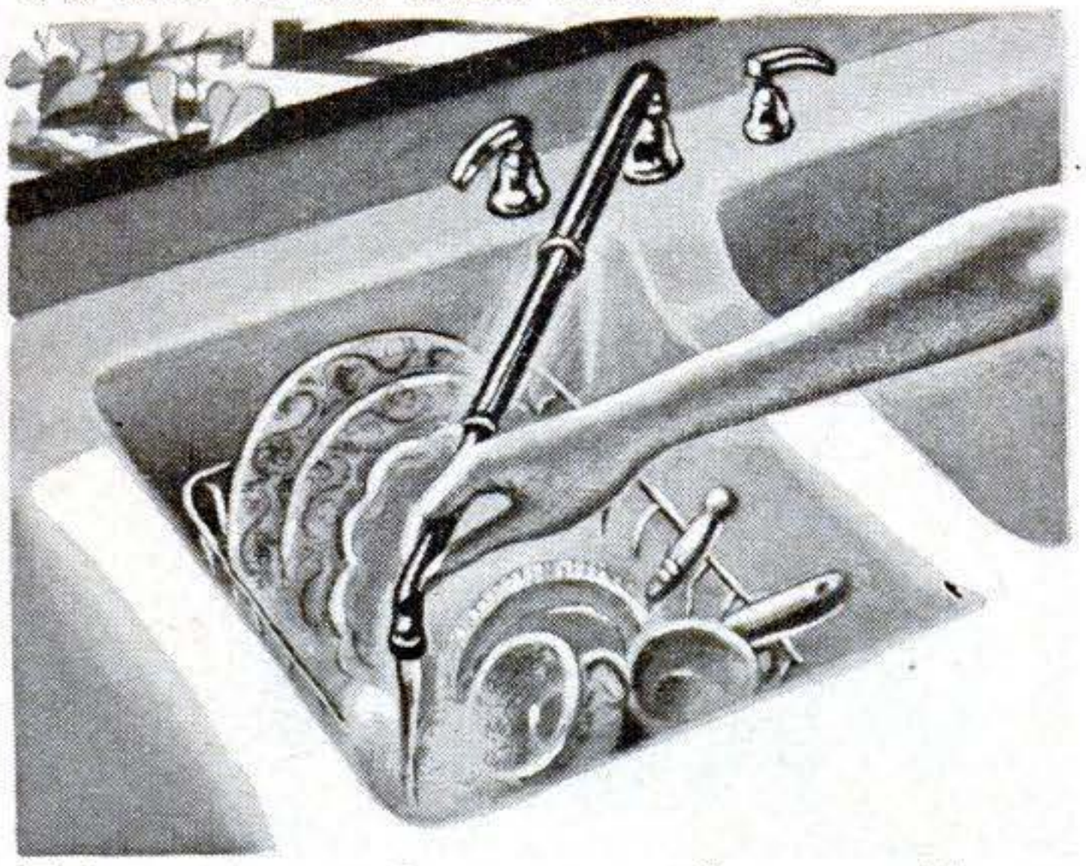
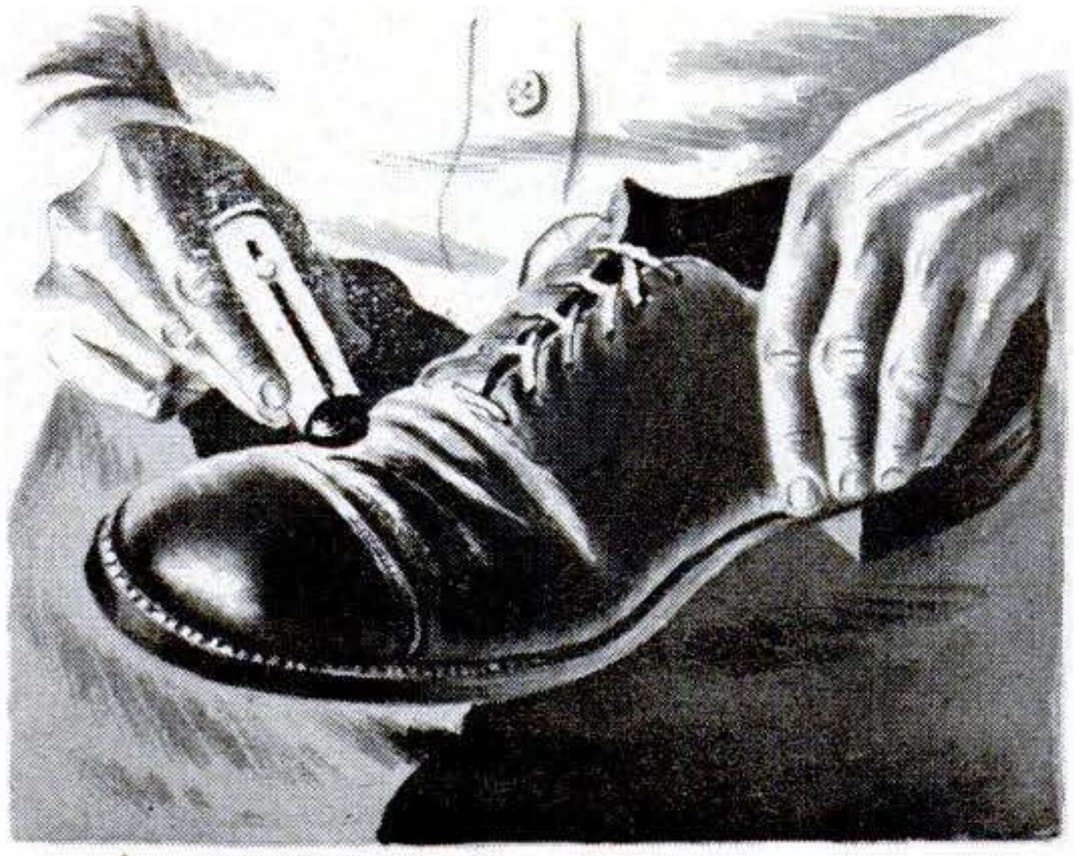
or Double-Your-Money-Back

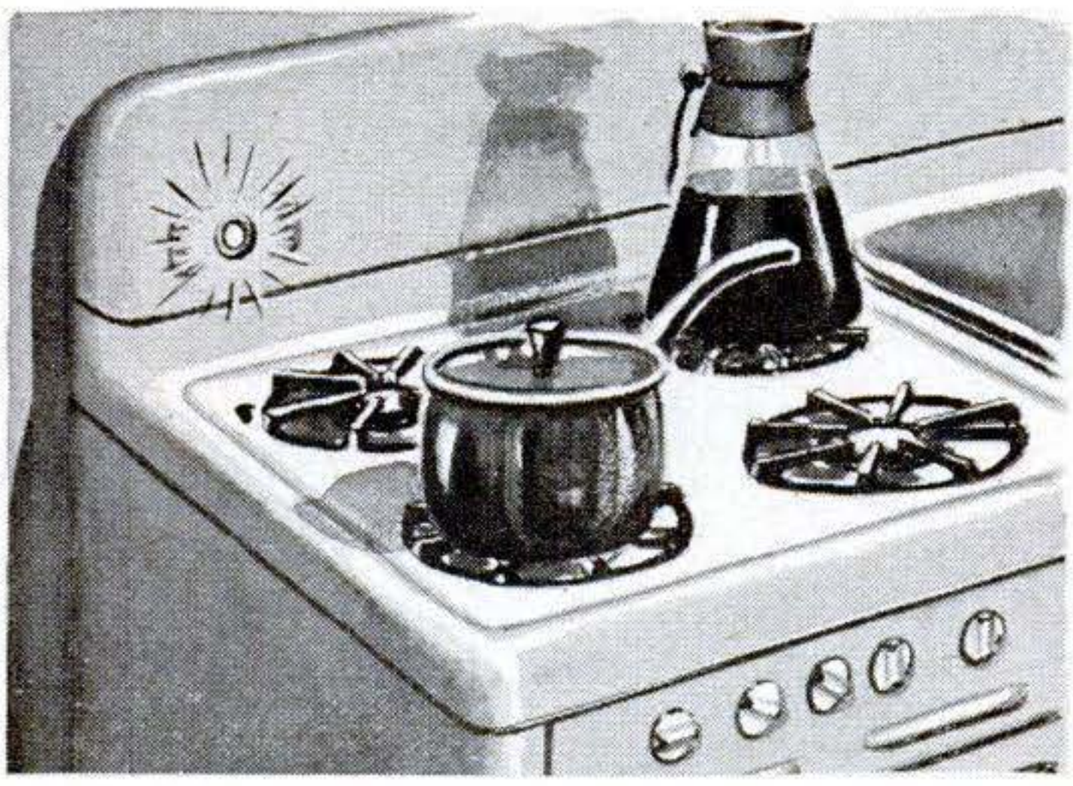
I'd like to see them make . . .



Telescoping sink spouts. These would not only swing from side to side as at present, but also would telescope so you could pull them out for rinsing over all parts of the sink.—*Alvin J. Mainus, Glendive, Mont.*



Shoe polish in sticks—like lipstick and some shaving soaps. It would be cleaner and easier to apply. As you used it, you could just push up the bottom of the tube.—*Joe R. Harrod, Dayton, O.*



Warning signals on gas stoves. Most modern stoves are equipped with electric lights anyway, so why not connect a red pilot light that would glow when any burner was on?—*John Regulski, Brooklyn, N. Y.*

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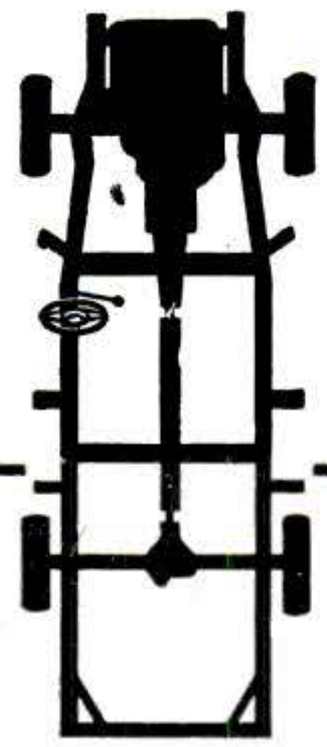
Solid Facts about the NEW FORD "FEEL"

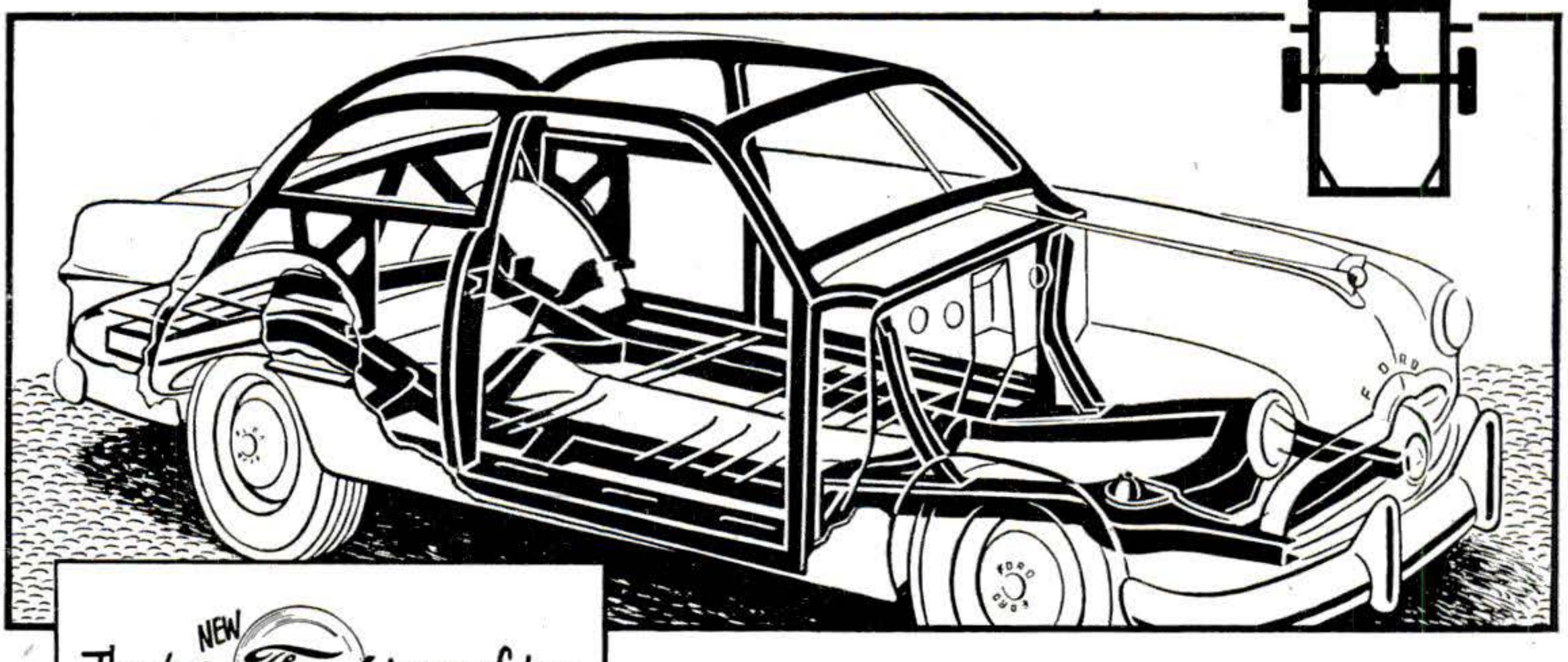
There's a new "feel" in driving and only Ford has it!

One of the most important parts of this new Ford "Feel" is the sense of solidity and strength that comes from the new Ford frame and body. Side rails of the new frame are box-section, and there are five sturdy cross members for even greater strength. (Convertibles and Station Wagons have even heavier frames.) What's more, the famous "Lifeguard" Body is made of heavy-gauge steel and, combined with the frame, gives 59% more rigidity than ever!

No wonder drivers everywhere are so genuinely enthusiastic about the '49 Ford's remarkable feeling of solid safety and reassuring roadability.

For the new Ford "Feel" is really a brand new *kind* of driving—with new ease of control, new performance, new security, new fine car comfort. Try it, and then enjoy the greatest feeling of all—the prideful thrill of owning the "Fashion Car of the Year"...the '49 Ford!





There's a NEW Ford in your future

"DRIVE A FORD AND FEEL THE DIFFERENCE"

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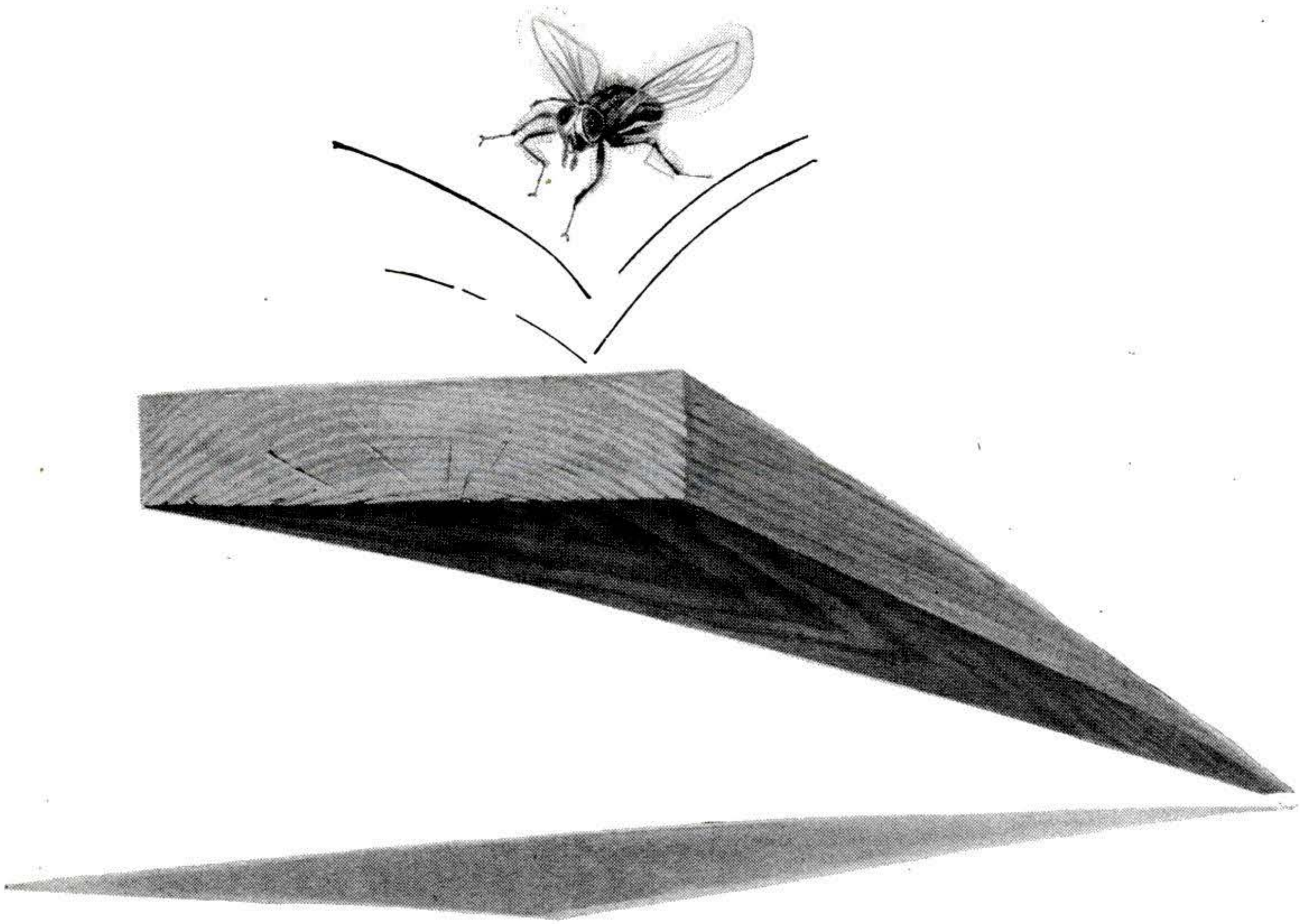

Supersensitive electron tube, developed by RCA, makes possible more accurate measurement of minute vibrations.

Can a housefly make a board bounce?

Surprising though it seems, a fly—when it lands on a board—causes distinct vibrations. They can actually be detected by a remarkable, and supersensitive, new RCA electron tube.

Slimmer than a cigarette, and only half as long, RCA's tube picks up vibrations with a pin-sized shaft—and these vibrations may then be converted to visible or audible signals. More important, the new RCA electron tube can be used to measure the degree of vibration.

Scientists predict many practical uses for this *electronic transducer*. Airplane designers can hitch it to engines or whirling propellers and locate vibrations which might lead to trouble. Oil men can use it to measure the sound waves from explosions with which they scout for oil.

And your smooth-running automobile of the future may be an even better car when the facts gathered by RCA's new tube are put to work.

Another RCA "first":

The electronic transducer, first of its kind, is one of many research achievements pioneered at RCA Laboratories. Such leadership in science and engineering adds *value beyond price* to any product or service of RCA and RCA Victor.

* * *

Examples of the newest developments in radio, television and electronics can be seen in action at RCA Exhibition Hall, 36 West 49th St., N. Y. Admission is free. Radio Corporation of America, Radio City, New York 20.

RADIO CORPORATION of AMERICA

World Leader in Radio — First in Television

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PS
The Voice of Science

How to Tell USSR About US

THE heaviest weight in the delicate balance between cold war and warm peace is the lump of plutonium that represents the greatest achievement of Western science and U. S. technology. The atom bomb is a huge and valuable military and political force. But it is not the best representative of the ideas that have made this country great.

Like it or not, we are in a war. It is a war of ideas, but it is probably the deadliest conflict in history because the stake is the sum total of civilization. In this ideological war, we are trying to tell a vital ten percent of the earth's population that our ways of living and working with each other are better people-operations.

We are beaming billions of words at the Eastern peoples. But we are not using the full force of our biggest weapon. *We are not putting out enough samples of the product.* We are not showing the results of our kind of living and working.

I would like to suggest that the best possible weapon in this ideological war would be packages of pictures. Pictures of the useful, interesting, enjoyable things and gadgets that are the products and by-products of Western science and U. S. technology.

Pictures of nuclear fission at work—and womanproof can openers; of nylon slips that need no ironing—and garden hose that doesn't soften in the sun or crack in the cold; of washing machines that measure their own soap—and guided missiles that smell their own targets; of shoes that are cheap, wear well, and look good; of ships that move through air or water without worry of waves or weather; of sealing wax that forms a million articles we know as "plastic" telephones, raincoats, movie film, paints, chessmen, fountain pens, book bindings, phonograph records, and surgical sutures.

These packages of pictures would not have to be prepared at government expense. The visual proof of democracy at work is already available. The Air Lift could transport these samples of the American Idea. Occupation troops could distribute them.

With no false pride, I suggest that every night we place along the Iron Curtain copies of POPULAR SCIENCE, *Popular Mechanics,* the Sears, Roebuck catalogue, *McCall's, Life,* and *The Saturday Evening Post.*

I think that by morning these samples would have vanished. And I think that, one fine morning, the Iron Curtain would be only a lace curtain.

The success of the Communists is due in part to hungry faith, but in the large to improved material satisfactions. The Russians "never had it so good" mostly because they never had as much before. If we can explain our big ideas in terms of little things, we can make vague beliefs personal and tangible.

In due time, we can explain to the Eastern world (and to ourselves) that these *things* of our living are only symbols of our life. That our comforts and gadgets are just a pleasant by-product of our belief that we should have a little fun while we are here. And that a better *life,* in span and satisfactions, is a product of better *living* in terms of sanitation, healthier babies, self-understanding—and good cooking.

Perry Gilkeson

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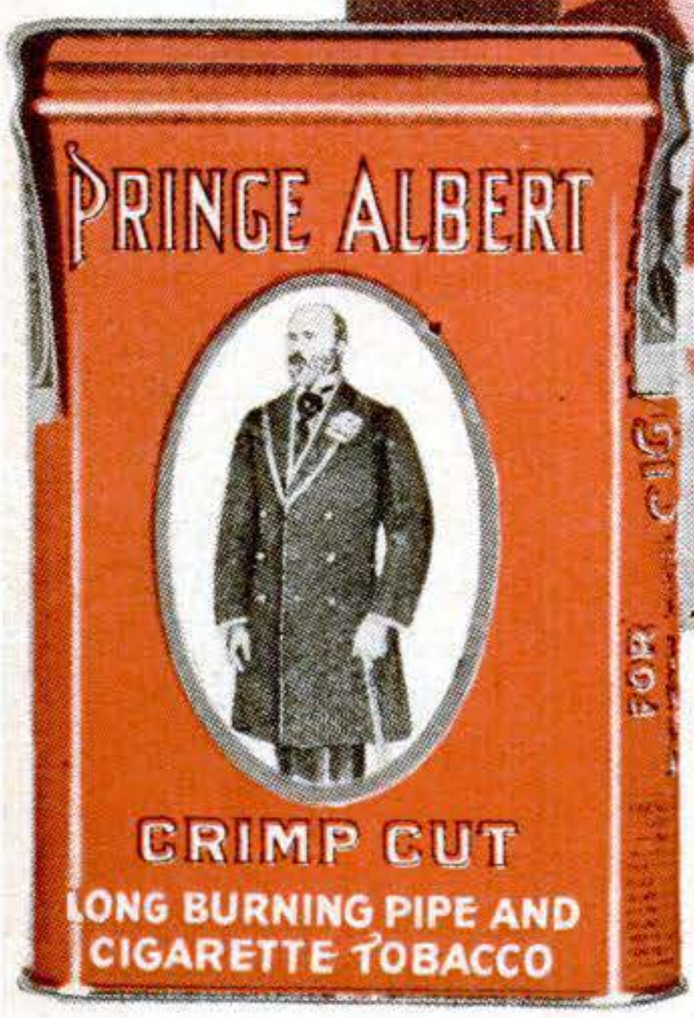
It's a happy meeting when you get p.a.*

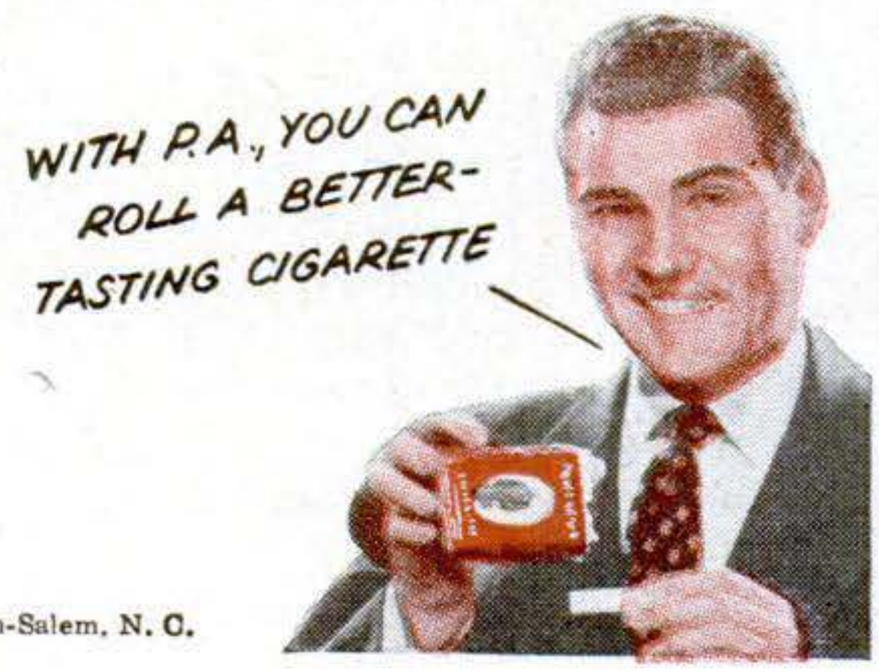
The NEW HUMIDOR TOP—locks OUT the air—locks IN the freshness and flavor.



p.a.* means pipe appeal means prince albert

● Yes . . . a girl enjoys meeting a man with Pipe Appeal—that extra attractiveness of the man who smokes a pipe. And when a man has "met up" with Prince Albert, he has found a rich-tasting tobacco that's mild and tongue-easy!

● Did you know that P.A.'s choice, crimp cut tobacco is *specially treated to insure against tongue bite?* No wonder it's America's largest-selling smoking tobacco! Get P.A. today for smoking joy and comfort!



The National Joy Smoke

R. J. Reynolds Tobacco Co., Winston-Salem, N. C.

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"Quick, Henry . . ." No, it isn't real. This ferocious-looking insect is a model, 25 times life size, of a female *Anopheles quadrimaculatus* mosquito—the kind that carries malaria. James E. Trott, artist-preparator in the Department of Zoology at the Chicago Natural History Museum, spent nearly two years making it, frequently working under a microscope with dental drills and other precise tools. The mosquito model, two feet long from leg-tip to leg-tip, is made of more than 20,000 separate pieces. The body was carved from acrylic plastic; the surface bristles and scales were reproduced in other plastics or represented by hair. This masterpiece of model-making craftsmanship is one of a series for a museum exhibit on mosquitoes and malaria.

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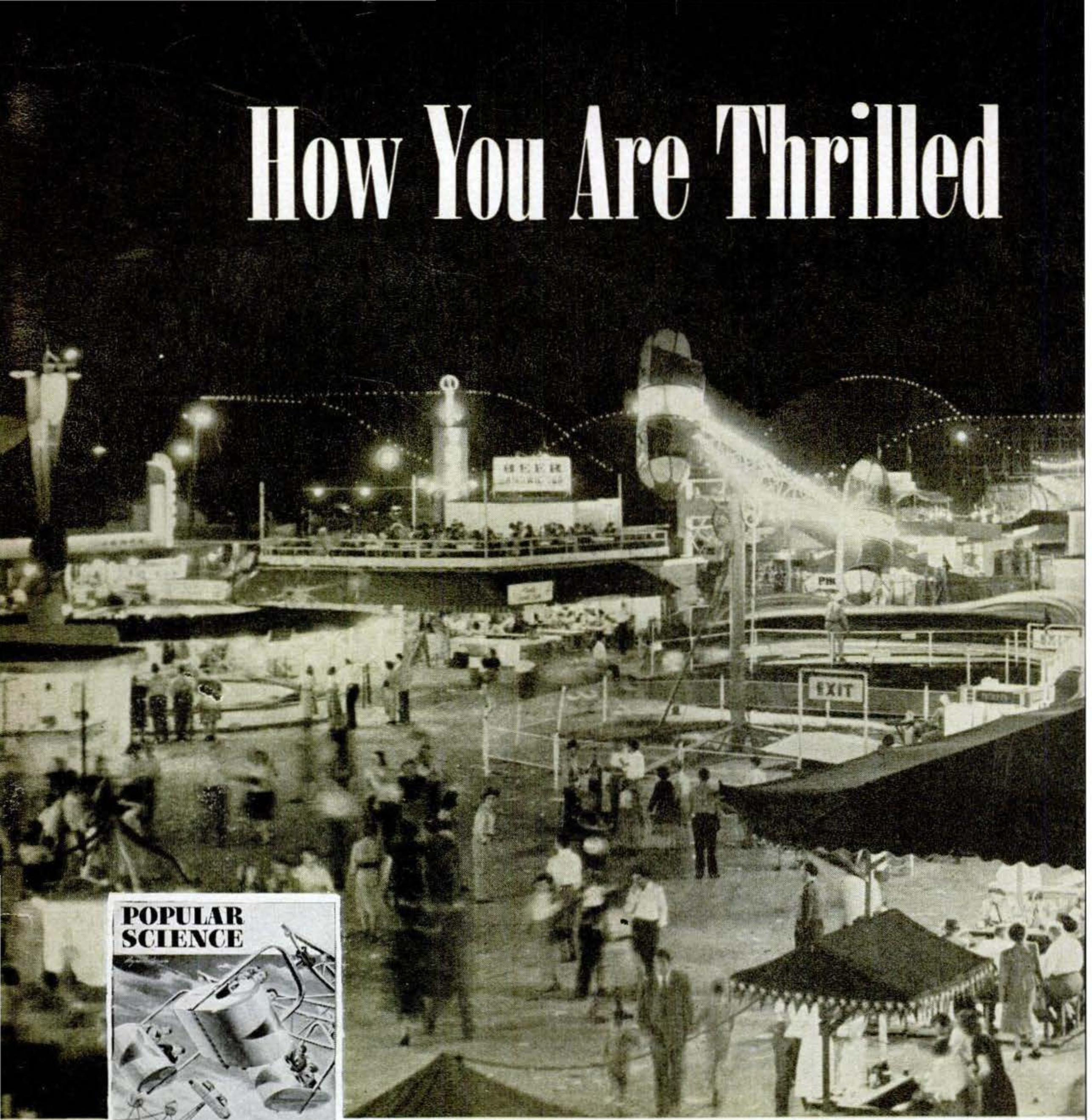
How You Are Thrilled



Cover drawing by Reynold Brown

Amusement operators work hard to scare you to death—and just as hard to avoid any real danger.

By Devon Francis

THIS month and all summer tens of millions of Americans—including, in all probability, you and your family—will ride in weird-looking contrivances at carnivals and amusement parks in the exciting conviction that they are braving death or injury, at the least. That's what sells tickets.

But it only looks dangerous.

The fact that the "rides" keep looking more hazardous every season is a tribute to the showmanship of the men who dish up the thrills. They have a credo: the successful ride is one that scares the living daylights out of you without actual danger.

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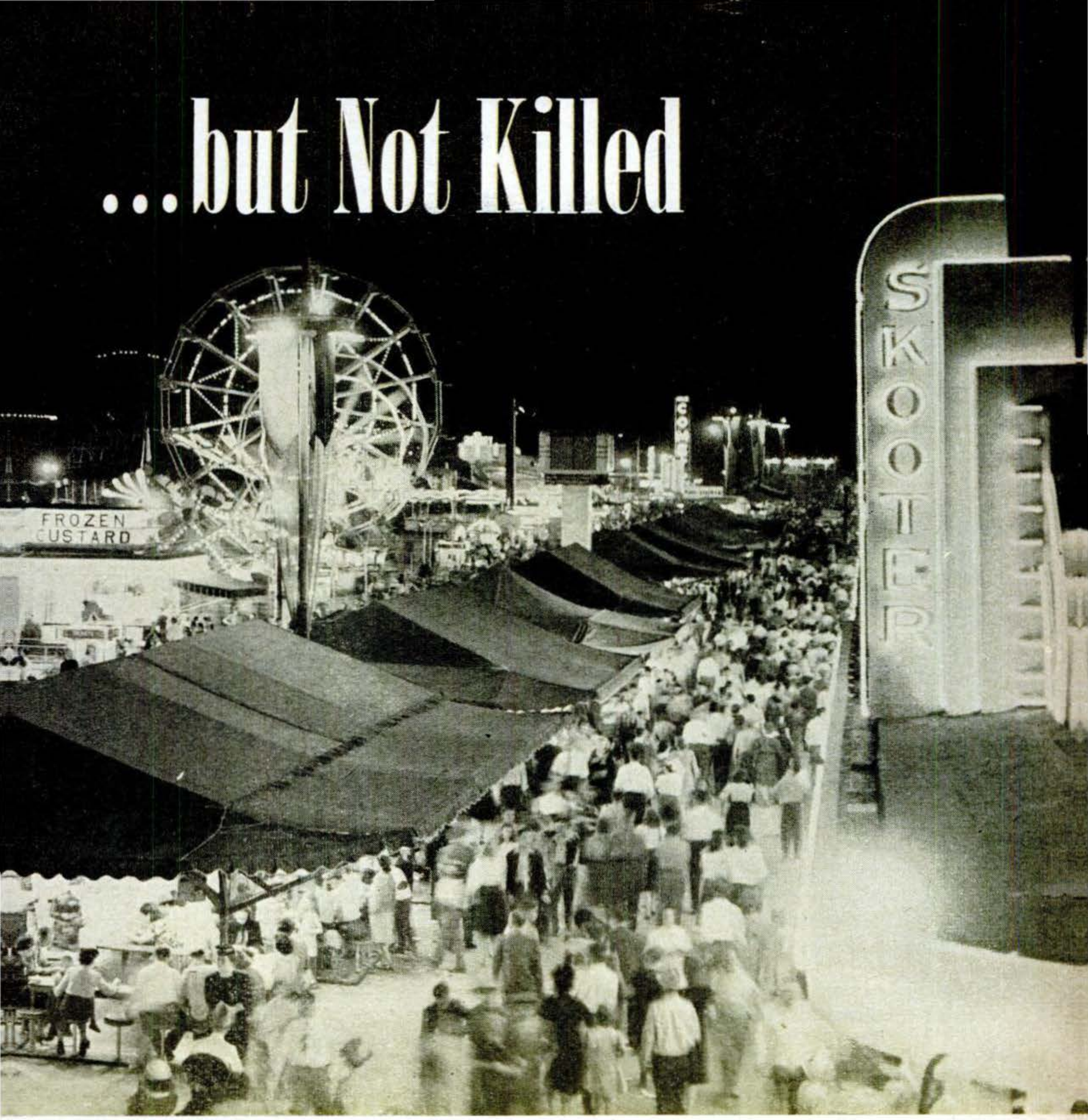
...but Not Killed



The newer rides this year snap you around like end men on crack-the-whips. Rube Goldbergs on the loose, they jounce, bounce, roller-coaster, drop, skid, and bump. They are complicated. Most of them have cages or cars whizzing and whipping around like satellites that seem to have no orbits. Some include a control that lets you imitate an airplane's loops and rolls. One, making like a cockleshell in a heavy sea, is positively frightening to those of us on the downgrade side of forty. Another has cars that, not content with going up and down and circling their centerpole, move in and out on their support arms as the operator changes the speed of rotation.

All the so-called "flat rides"—like merry-go-rounds—and most aerial rides offered by 350 traveling carnivals and 400 permanent amusement parks throughout the United States depend on the principle of the centrifuge to make you hang on for dear life. Whirl a bucket of water around your head and you have a crude centrifuge. The outward force exerted depends on three factors—the length of your arm,

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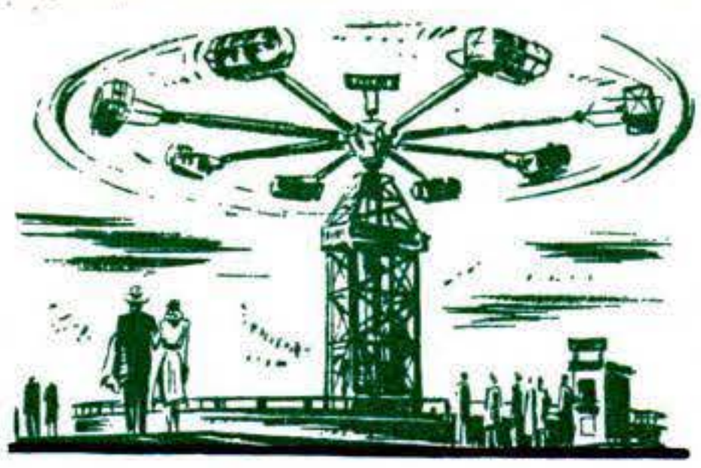
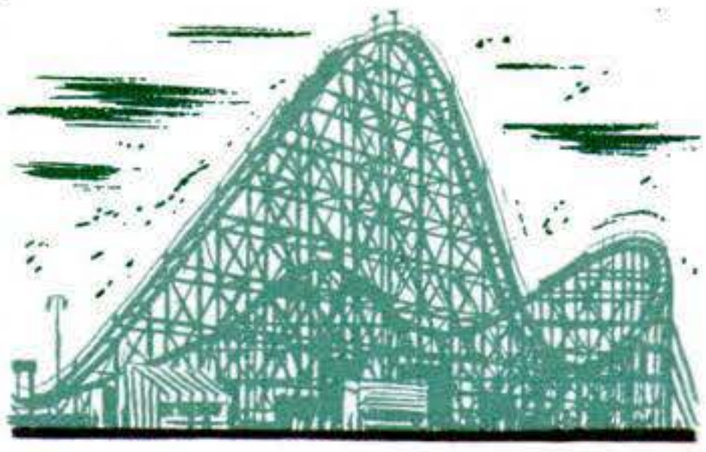
THE NEW RIDES ARE VARIATIONS OF THESE THREE

Flat rides—merry-go-round is typical—are pancake-shaped and on the ground. Others: whip and C-Cruise®.



Aerial ride takes you off ground and around centerpole. Height results from action of centrifugal force or lifting device.



Towed, or tracked, ride is only one of three standard types not using the centerpole. Roller coaster is example.

the weight of the bucket, and the speed of rotation. "Carneys" and amusement parks take full advantage of these facts of physics.

The backbone of these rides is the steel centerpole, beefed up to take heavy stresses. From the pole radiate arms to hold make-believe boats, airplanes, or tubs. These are called "buckets." The buckets may revolve in the air or ride on rails.

Surprising variations have dressed up the standard rides in the last decade, as carney and park operators demanded new thrills for their ticket-choppers to offer you. Two of the largest manufacturers and originators of rides are the National Amusement Device Co., of Dayton, O., and the Allan Herschell Co., of North Tonawanda, N. Y.

Some of the new breath-stealing aerial rides are tilted 45 degrees off the horizontal. This provides a zoom-up that is much like the chandelle maneuver in an airplane. If you don't want your stomach in your lap, you'd better not buy a ticket to this one.

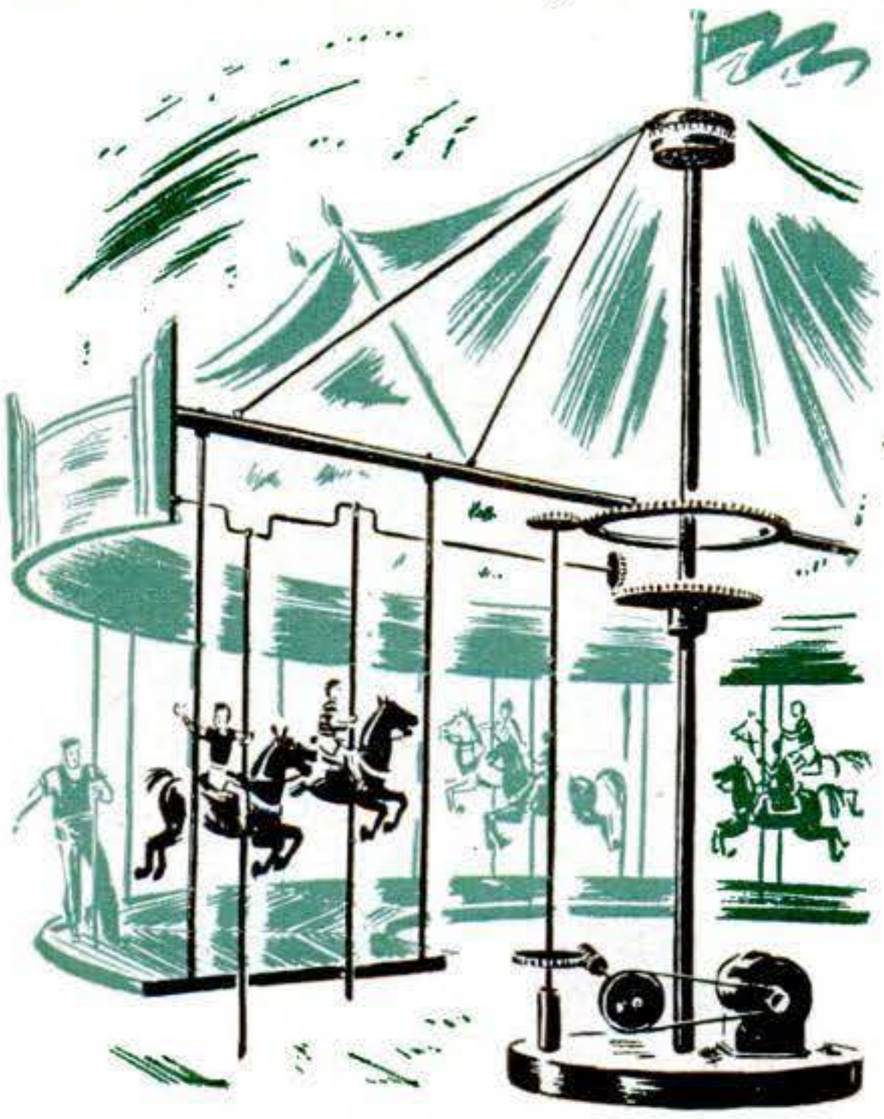
One ride makes you clutch for support by a simple expedient. It alters the shape of a triangle described by the centerpole, the support arms for the buckets, and a cable connecting the buckets to the centerpole above the arms. A crank pulling first at one bucket and then another squeezes and opens two sides of the triangle to make the buckets go up and down.

Another gives you a choice. If you want to ride around sedately, as on a Ferris wheel, you just sit there. But if you want to go end-over-end, all you have to do is operate a brake that freezes your car to its axle. This is not recommended to the faint-hearted. Still another ride, a variation of one that has been on the market for years, lets you barrel-roll with a control connected to out-size ailerons in the windstream.

Selling thrills with safety depends on supervision, vigilance, maintenance, and

MERRY-GO-ROUND IS MOST POPULAR FLAT RIDE

Simplest and one of the most popular of all the flat rides is the merry-go-round. The platform is turned by the motor through a gear train that surrounds the centerpole but is not coupled to it. The horses are made to move up and down by cranks connected to the motor through auxiliary gearing that is attached to centerpole. Reins, straps, other devices assure safety.

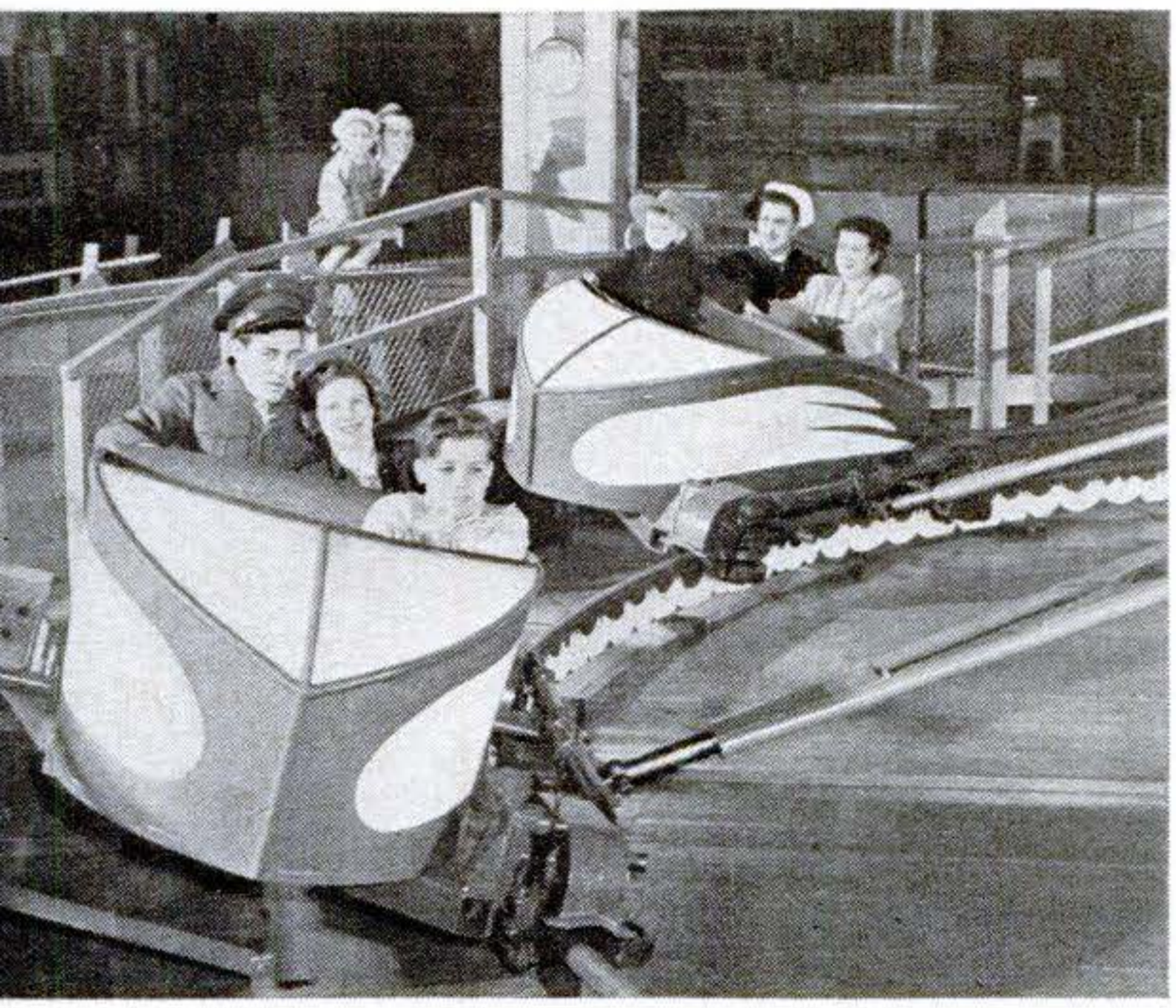


elaborate safety devices. Maintenance is such a fetish that each spring the magazine *Billboard*, bible of the industry, religiously runs articles on keeping rides in condition.

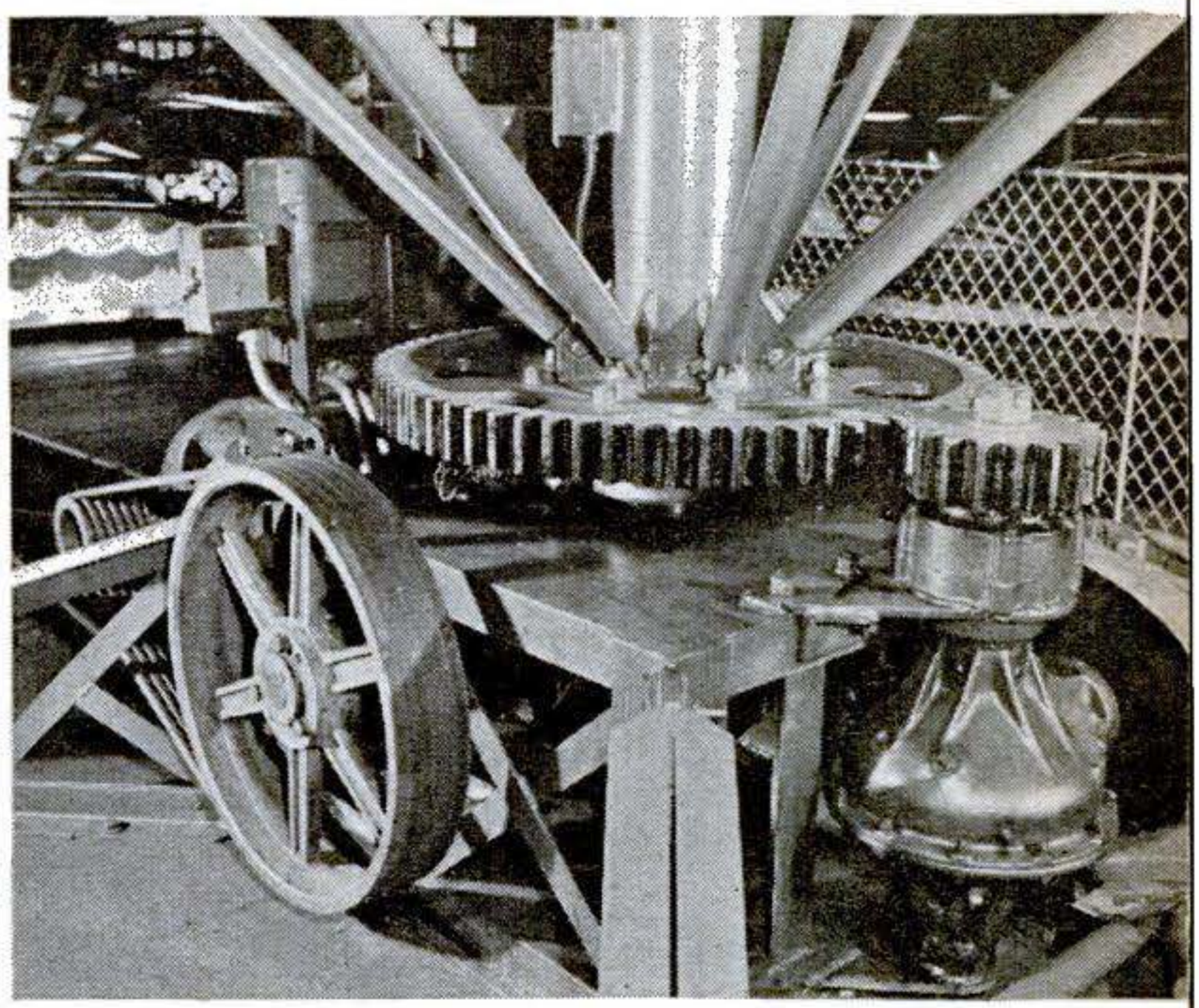
Every morning before opening time, mechanics go over each nut, bolt, and stay wire of all rides. They grease and oil. Roller coasters get an especially thorough going-over. Men "walk road"—every foot of the ride—just like trackwalkers for the railroads. And a good master mechanic can tell just from the sound of a ride whether it's working properly.

Even a casual eye and ear can detect some of the safety devices. Look at the iron bar against your stomach in a roller-coaster car. It keeps you from standing up. It can be released only by an attendant, or by a metal-stripped wooden dog alongside the track just short of the unloading platform. Listen to the car as it is drawn up the incline for the first dip. That clicking noise is a dog tripping over a ratchet. If the propelling chain should break, the train can slide back under gravity exactly two inches, no more. The chain itself has a safety device that keeps it from sliding downhill if it breaks.

Roller-coaster cars have three types of wheels in contact with the rails: wheels to



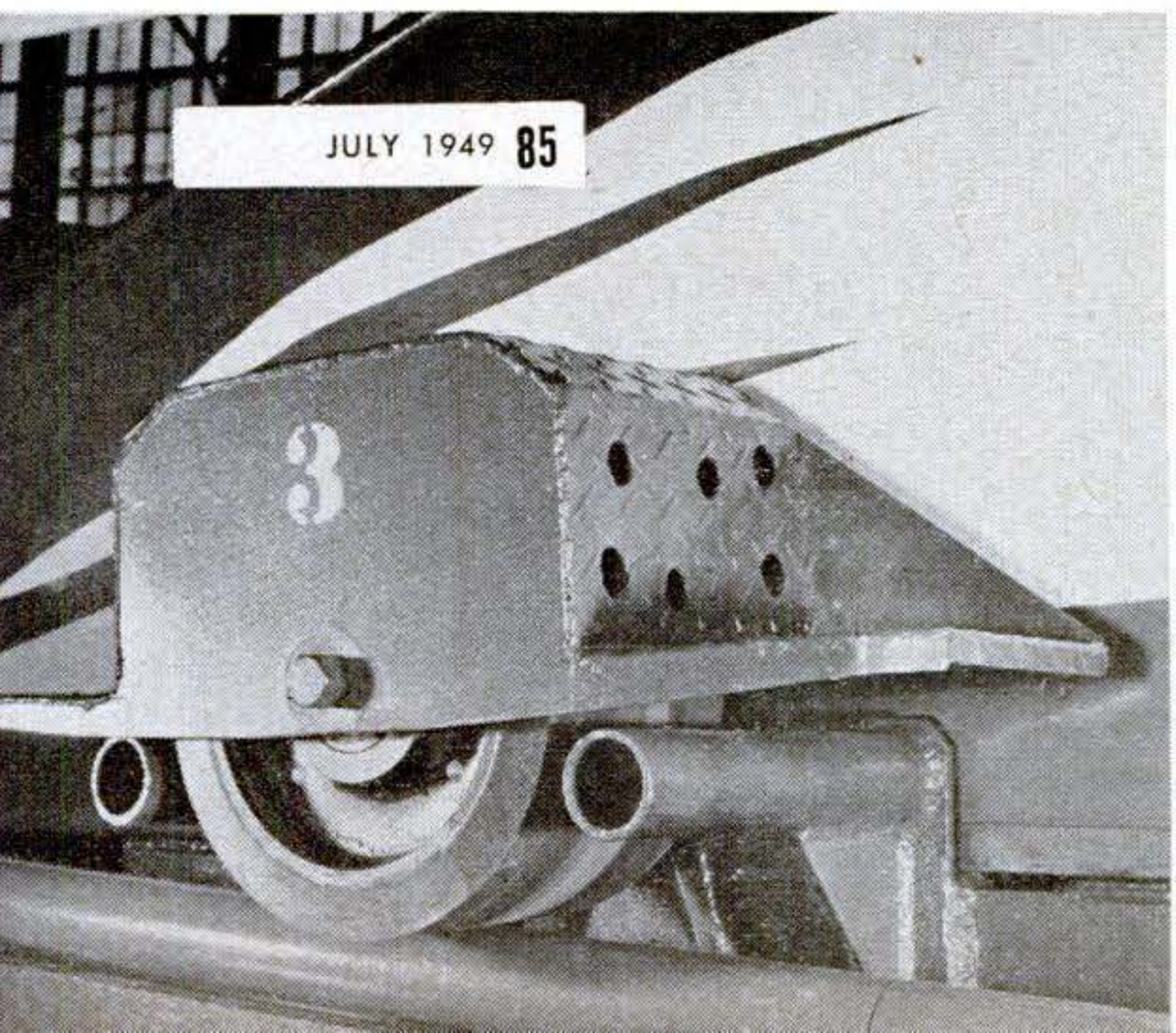
C-Cruise, made by C-Cruise Corp., West Salem, Ore., simulates boat's motion in heavy sea with hilly double track. Rocking motion is caused by mis-matching heights of opposing rails.

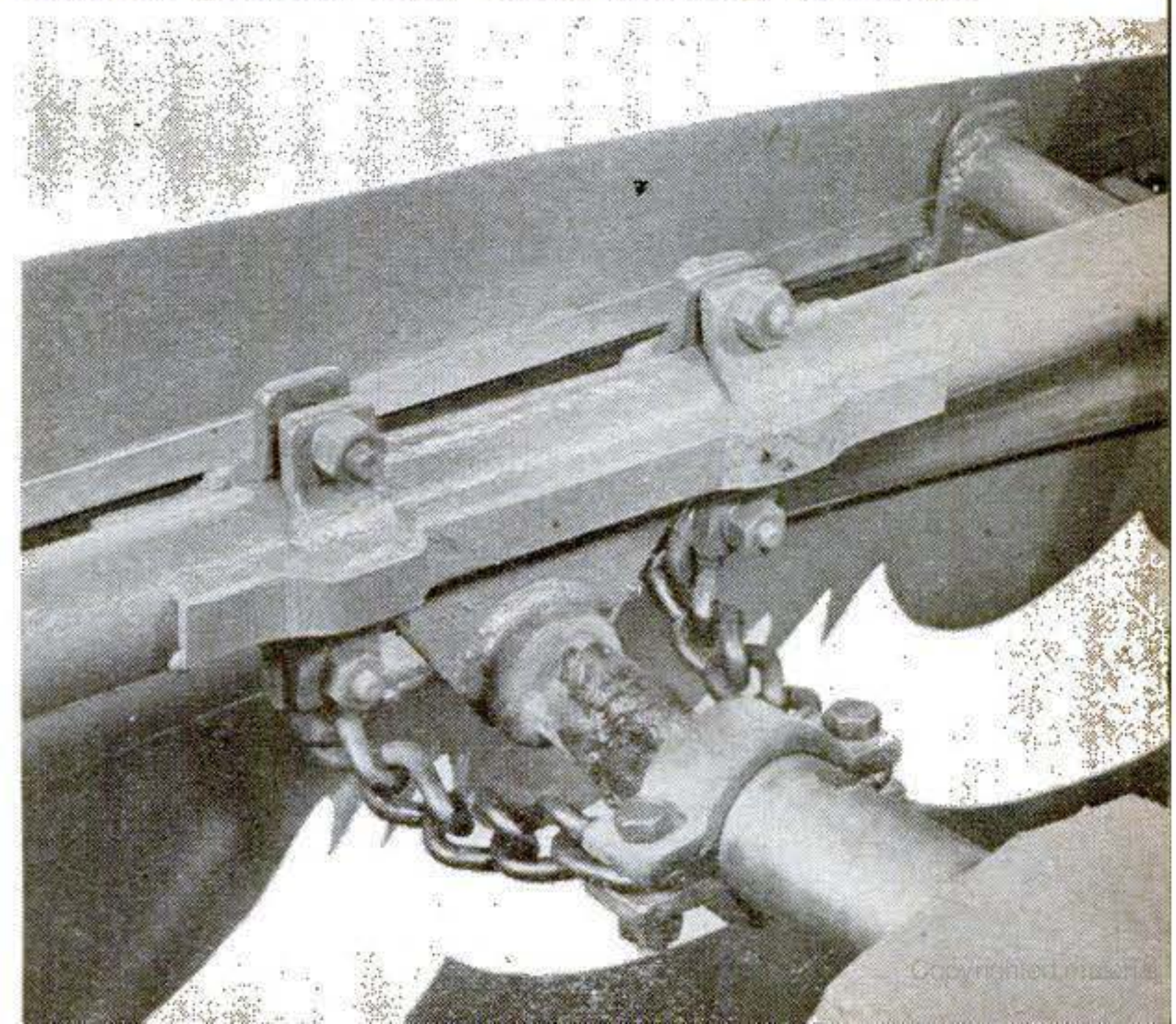


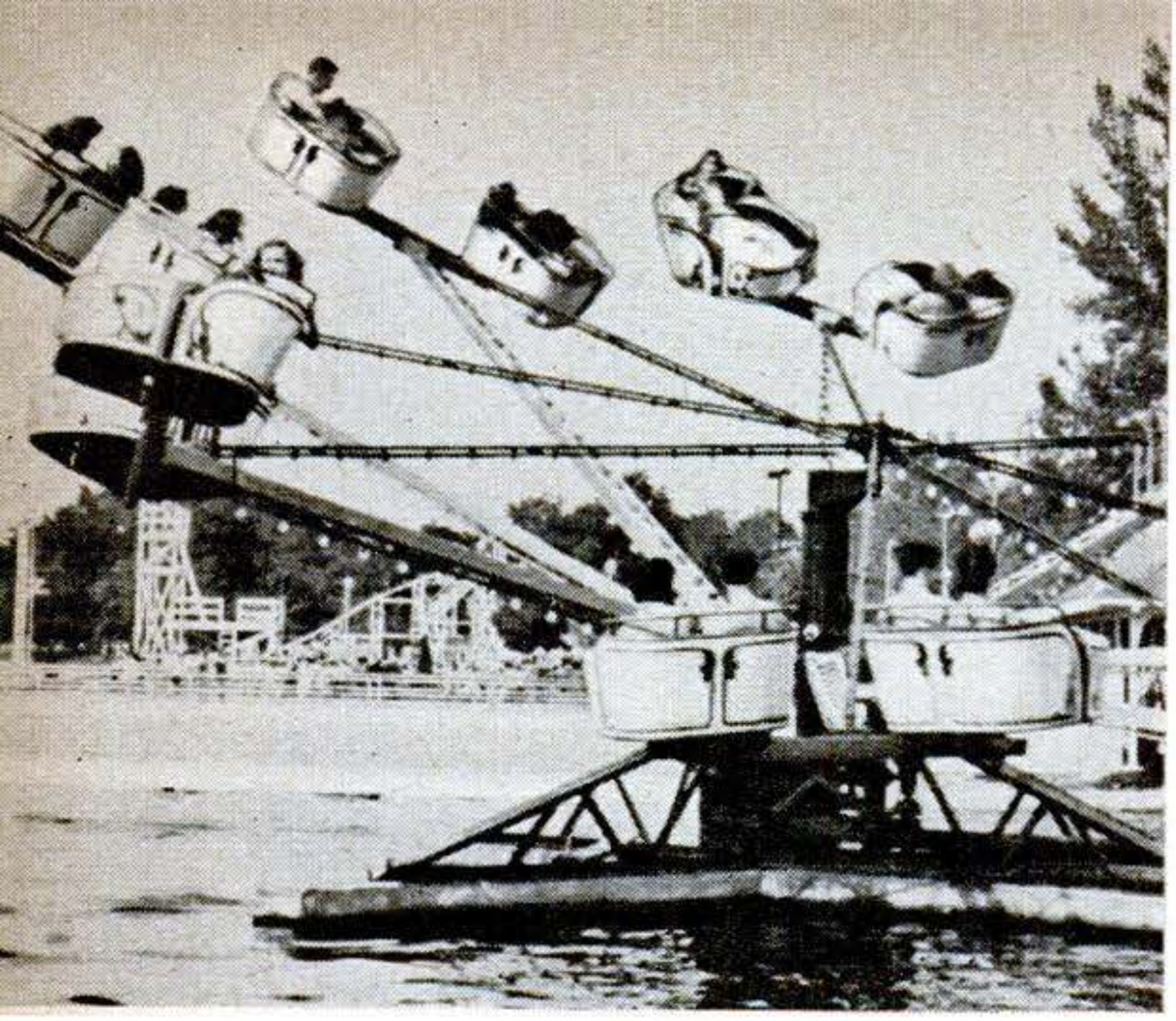
Power is supplied by a 15-hp. motor, driving belt and auto type of gear. Sturdy support arms from centerpole hold hinged sweep arms that drive cars around the 46-foot circle.

Pipe skids welded to boat support it on rails in case an axle breaks. Holes in wheel housing were found necessary for cooling the molded-rubber cushioning inserts in the wheels.

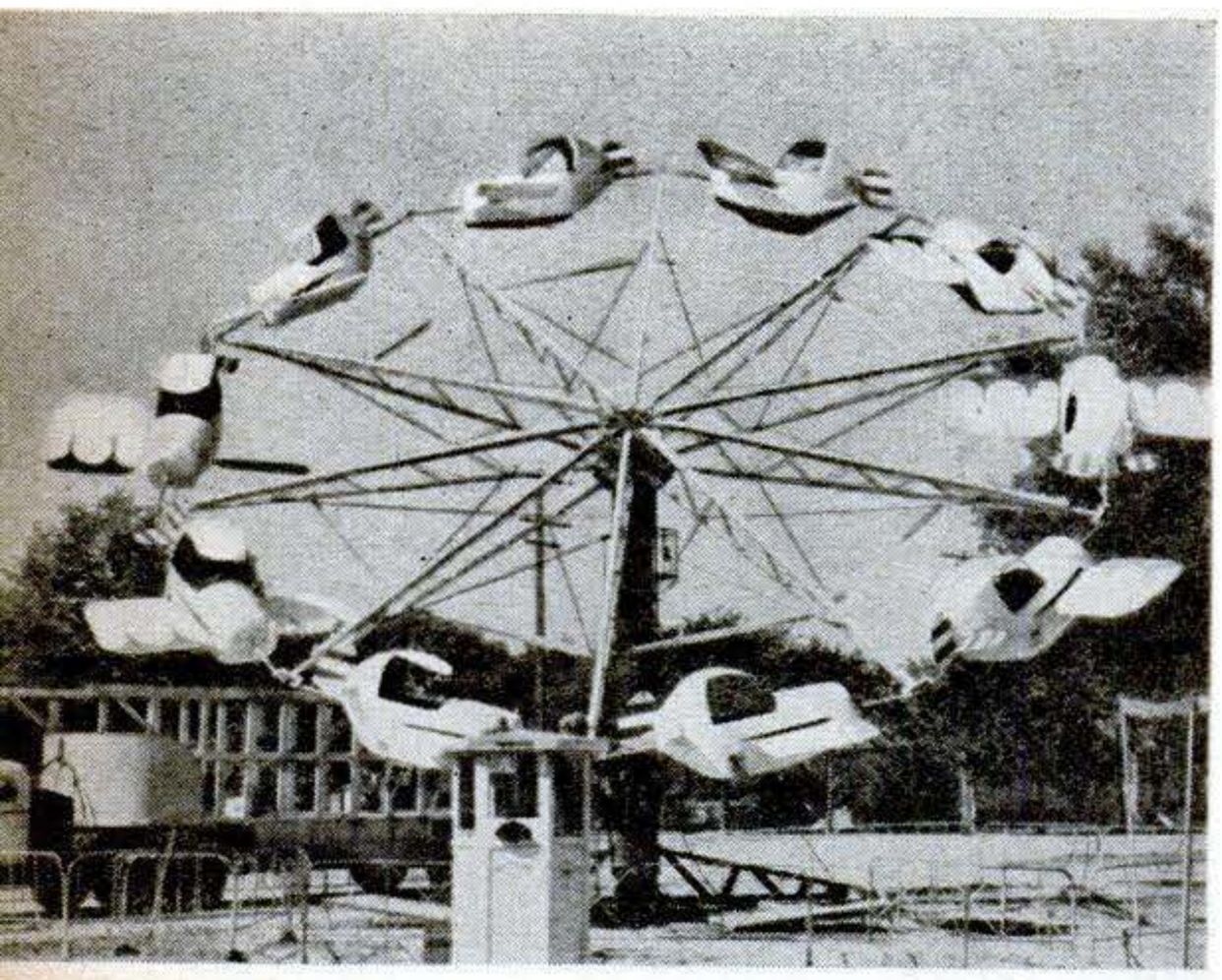
Another safety device is chain to keep car in motion if sweep arm breaks at attachment point. Extra wheels inside rails, like those on roller coaster, prevent cars from shifting sideways.



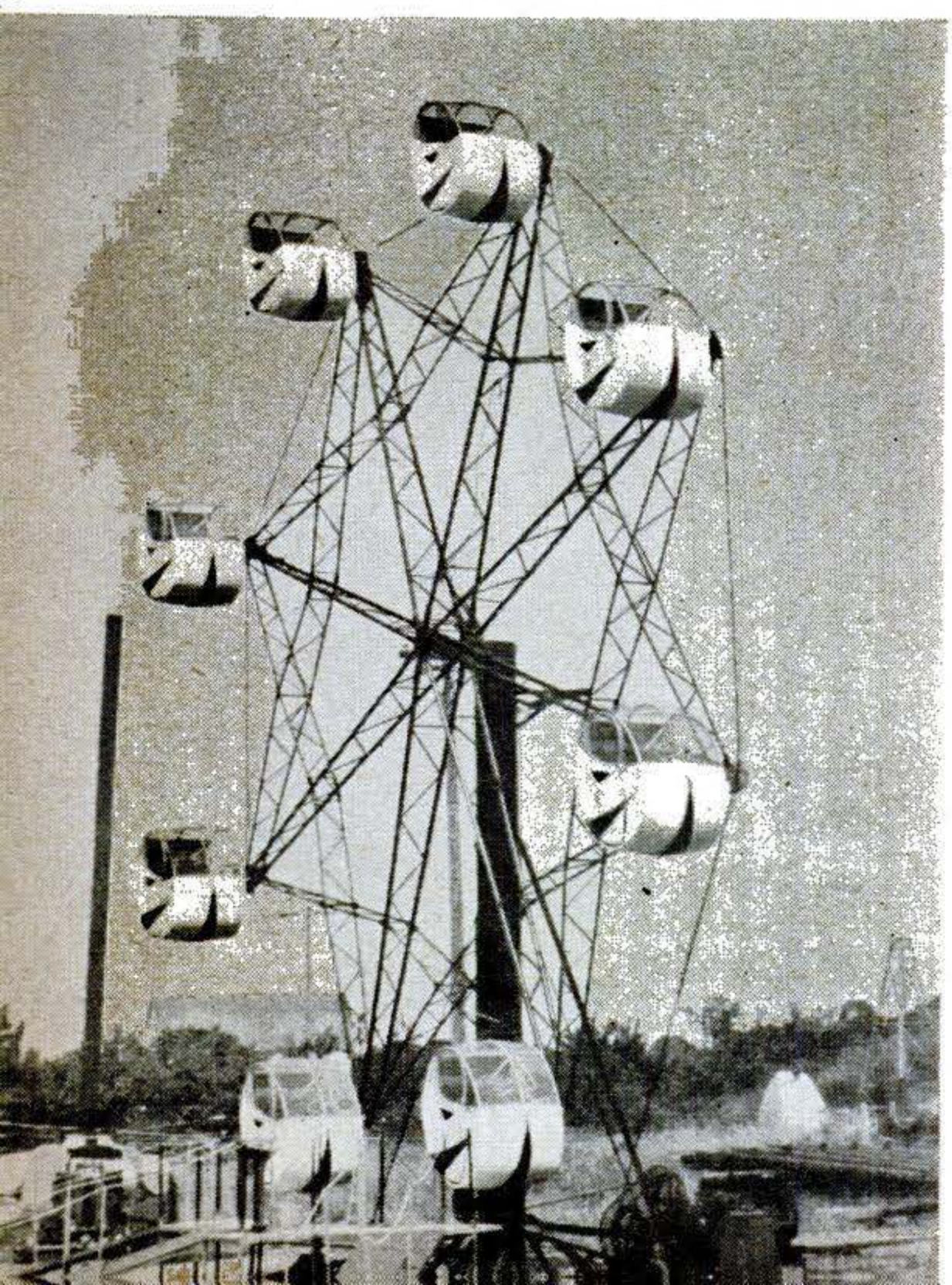




The Octopus® has two centerpoles, one inside the other. The outer centerpole whirls the buckets. The inner one has a crank turning in the opposite direction. It pulls on cable to make the buckets move up and down. This ride is made by Eyerly Aircraft Co., Salem, Ore.



On Spitfire®, planes travel in circle inclined at 45 degrees to centerpole to simulate diving, climbing. Passenger can move big ailerons to make plane barrel-roll—rotate on its long axis. Frank Hrubetz & Co., Salem, Ore., makes it.



The Rock-O-Plane® is a Ferris wheel with a difference. A hand control locks the car to its axle so that it can no longer turn on the axle and remain upright. That means the car does a slow loop. An automatic safety bar clamps across rider's lap when the door is closed, holding him in his seat even when upside down.

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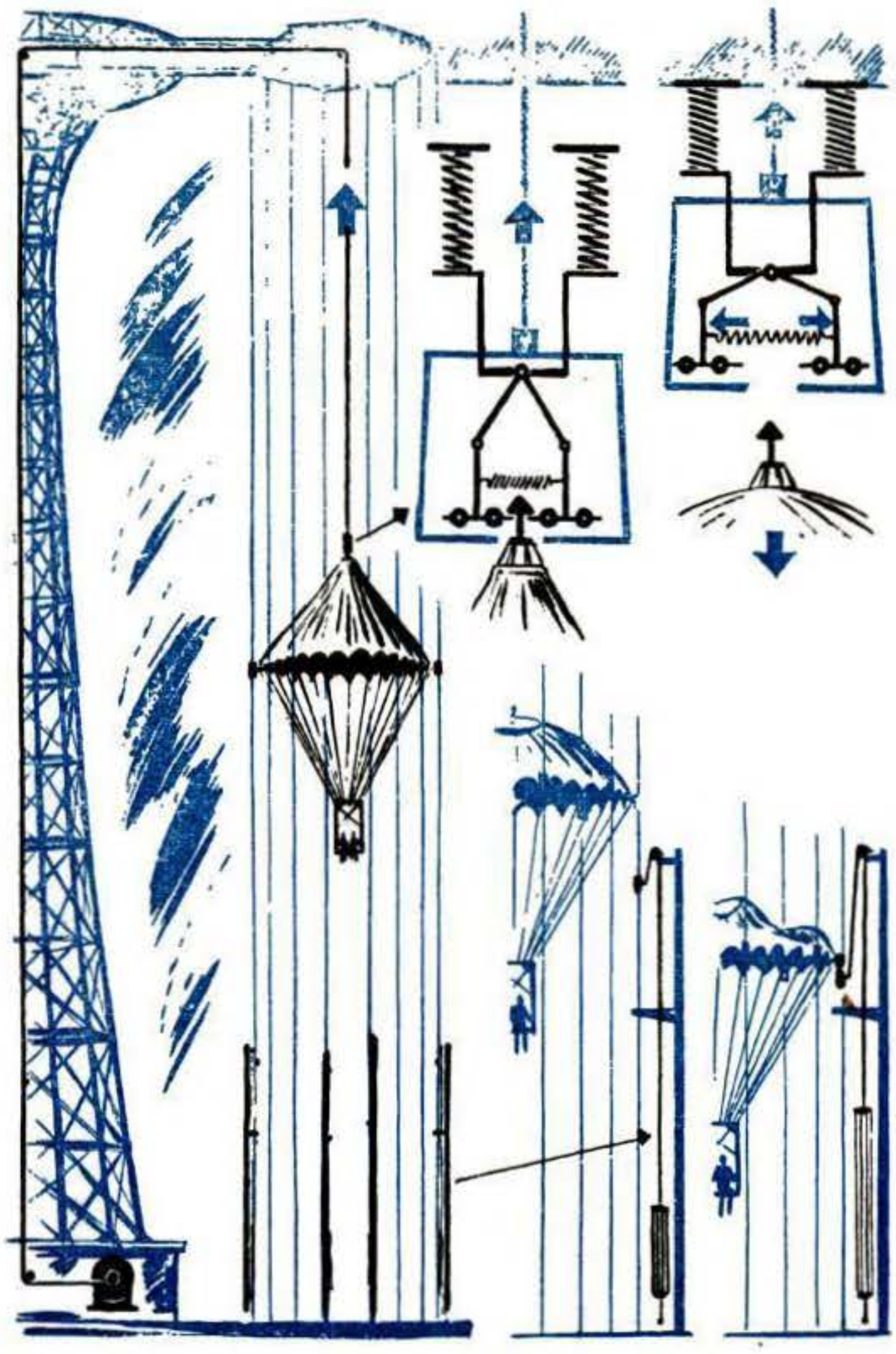
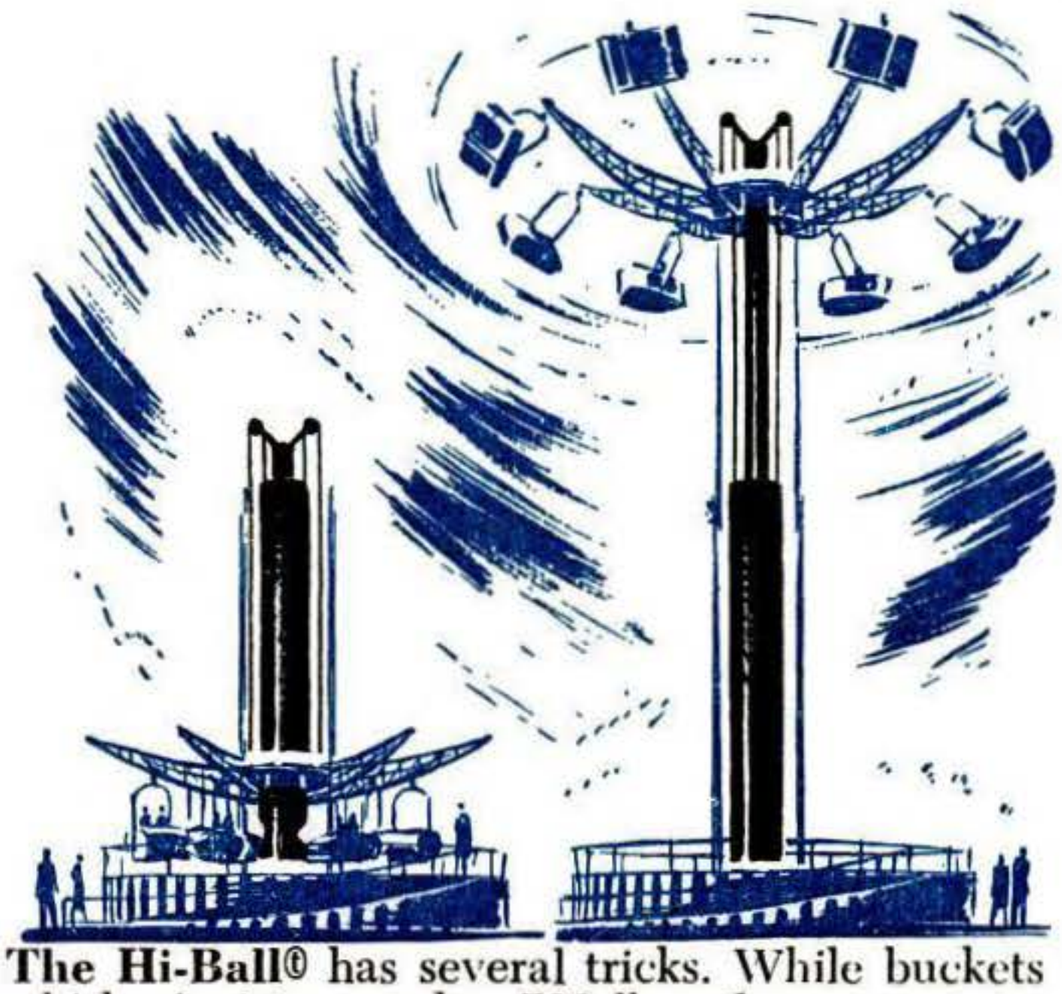
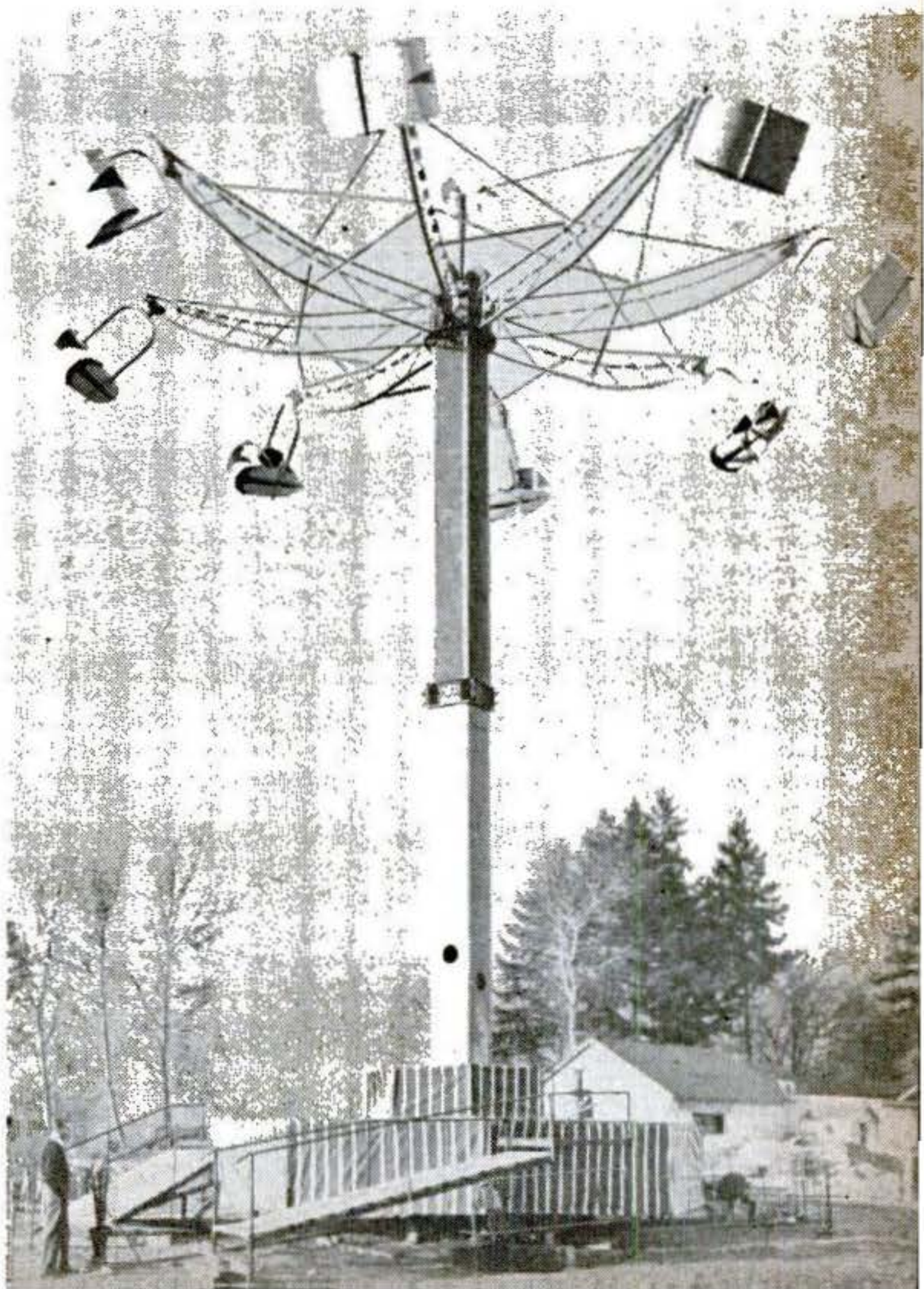
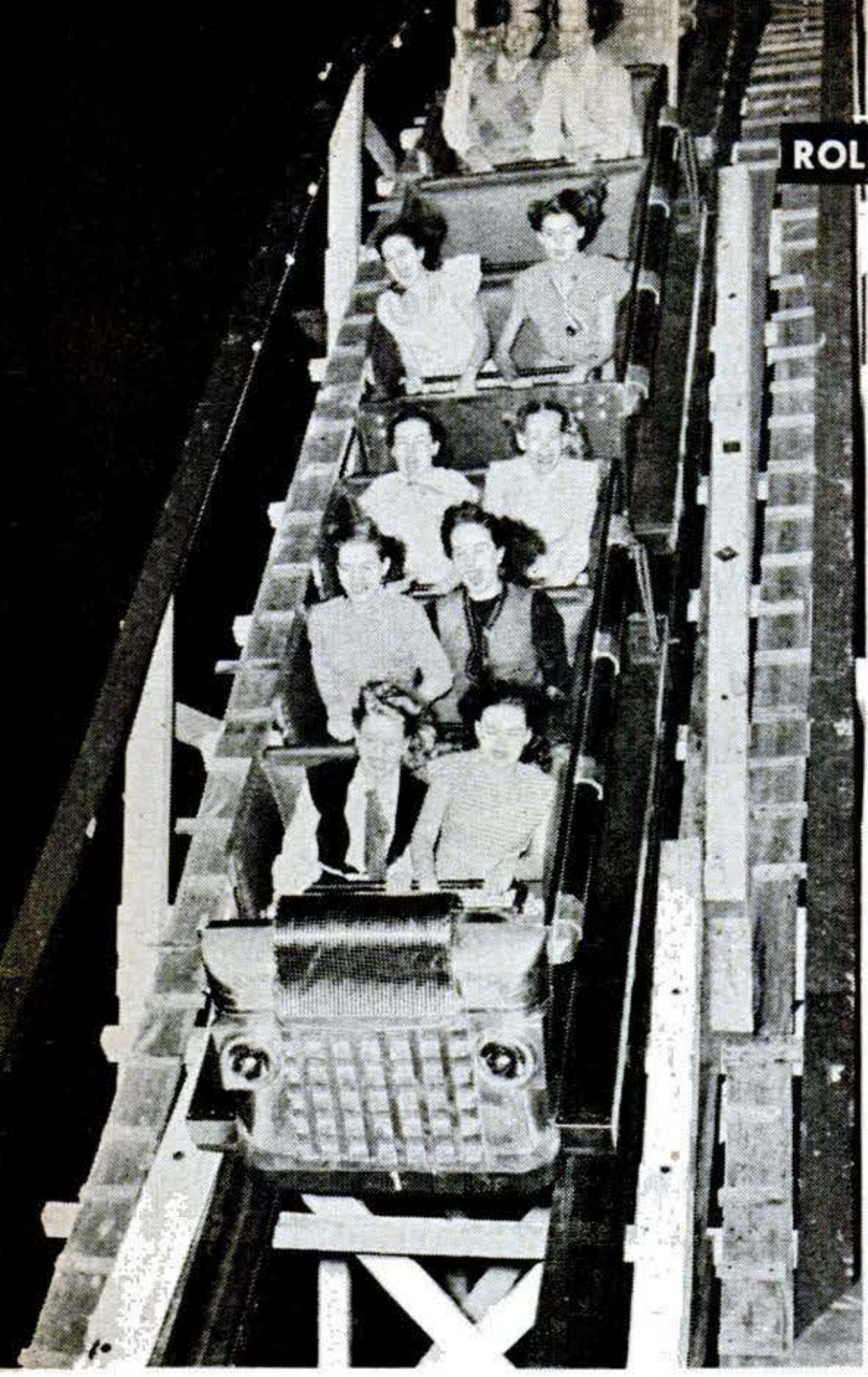


Parachute jump at Coney Island's Steeplechase Park, only ride of its kind in U. S., hoists a deflated 'chute 250 feet up. When individual release mechanism (like a cupboard catch) hits top of tower, arms slide apart, permitting the spearlike hook attached to the parachute to drop out. The released 'chute then falls free, but its path is guided by eight cables. Near the ground, the rim of the 'chute is caught by rubber shock cords that cushion the landing.

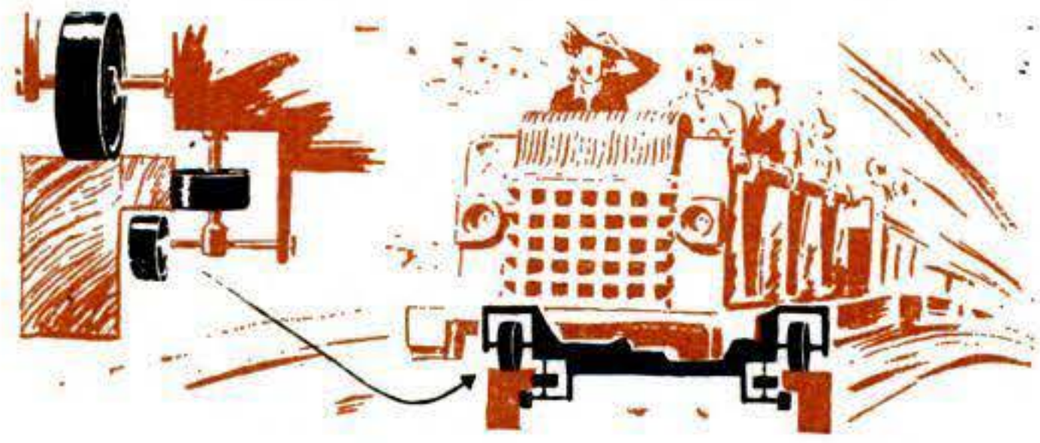


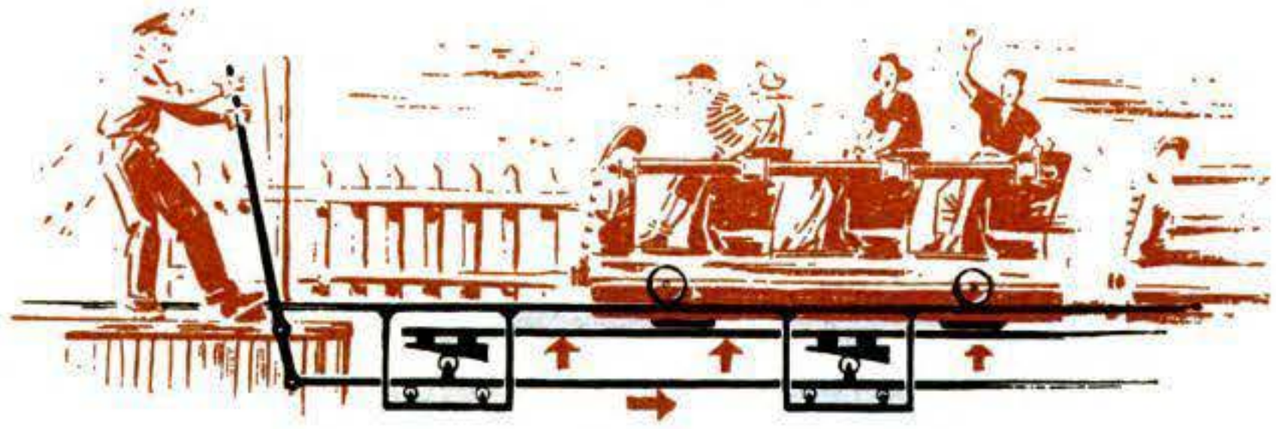
The Hi-Ball® has several tricks. While buckets whirl, a piston under 500-lb. oil pressure extends the telescoping centerpole, raising the passengers 52 feet. The operator can adjust rotation speed. Above 10 r.p.m., centrifugal force makes the buckets slide from midpoint of support arms up the curve to the very tip.

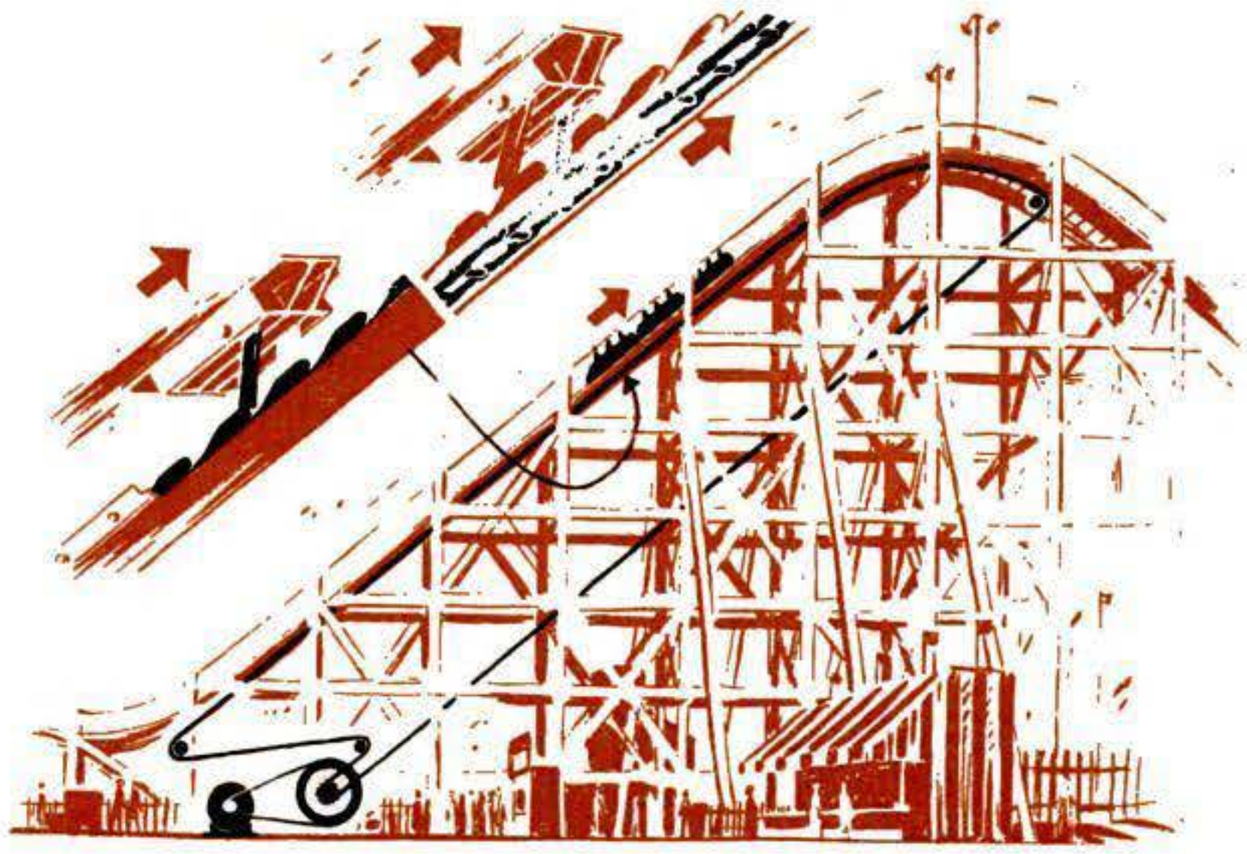




ROLLER COASTER IS THRILLING TOWED RIDE







Elaborate safety precautions, indicated in the drawings at right, help keep the roller coaster a popular ride. Support and guide wheels (top) prevent the cars from leaving the track in any direction. Brakes, which use rollers and wedges to raise an extra rail against the car brake shoe, are controlled by one operator. They ease the trains on the lifting chain, can stop them in emergencies, even in the middle of a ride, and slow them to unload. Seat safety bars, locked at start, can be released only by track dog or attendants. Dogs and ratchets on power hill prevent either train or chain from falling backward if chain should break. *Drawings by Ray Pioch*

carry the weight of the buckets, undertrack wheels to keep them from flying upward off the track, and side-friction wheels to help keep them on course.

Thrill Hills Built of Wood

And don't worry if the structure of the 'coaster is made of wood. That at Steeplechase Park, in Brooklyn's Coney Island, like hundreds of others in parks from Maine to California, is built of a special kind of wood—straight-grain, long-leaf, yellow pine. Wood is used because it makes better curves, hills, and valleys. It shapes to a template easier than metal. The track at Steeplechase, one of the oldest of U. S. amusement parks, consists of five layers of structural timbers, each two inches thick and eight wide. It is bolted and nailed to uprights called bent posts. Every second bent post in the layout could be removed, and the structure still would take the stresses imposed by a fully-loaded, three-car train weighing more than 16 tons and attaining a top speed of 60 miles an hour.

Even the merry-go-round, perennial favorite with the public, has its assortment of safety gimmicks. There are straps to hold the kids on the horses; reins, stirrups, and an individual centerpole to grasp. And if you

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glance down to the platform at the point where a sleeve encloses the pole, you probably will see a slot cut at a right angle to the ride's direction of travel. That's to allow the horse to "bank." It makes his saddle easier to sit.

The safety problem in rides varies with the type of operation. In carnivals it is complicated by the fact that such shows, which play 2,200 fairs in a 20-week season besides scores of "still dates," or solo appearances, must be mobile. Mobility means light weight, consistent with safety. A ride must be large enough to carry a payload, yet the parts must be small enough to be assembled by the two or three men who run it. It must be easily repaired. That's the reason you will often see standard automobile parts in the gear trains of rides.

Safety in the established amusement park is more easily assured. Bolts, nuts, and cotter pins replace carney quick fastenings.

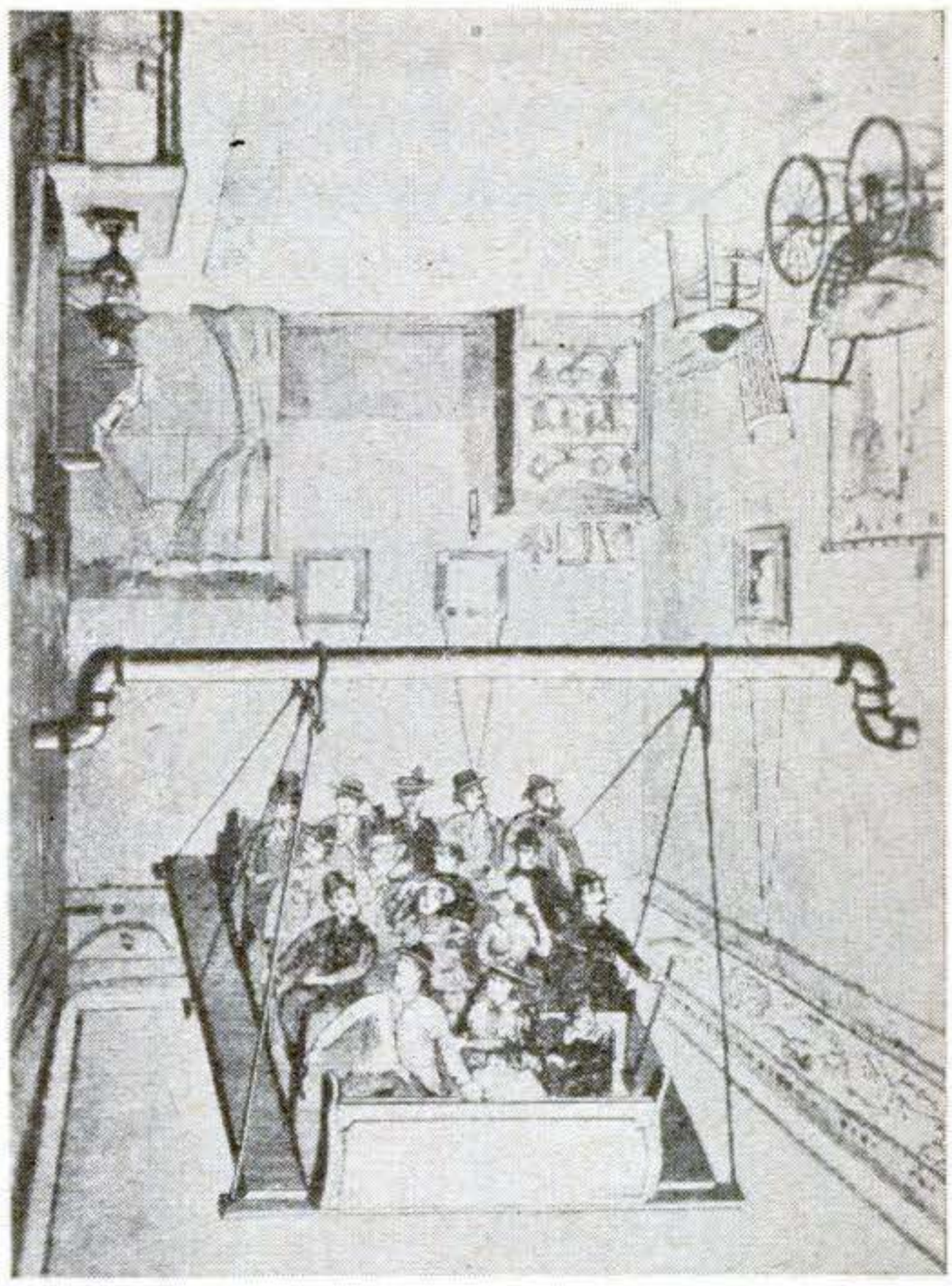
The manufacturers of the rides take a lot of trouble to contrive new ways to scare the wits out of people without inviting lawsuits. In some cases they build scale models for stress analyses. In full scale they overload the cars with sandbags. Often they deliberately run a ride to destruction to spot any weak points.

But in big parks—like Steeplechase and Chicago's Riverview, with 36 rides each—a new contraption is rarely put into operation just as the cautious manufacturer designed it. The managers look the thing over with a bilious eye. Driving arms welded to the centerpole are beefed up. Chains are added to stop the flight of a car if an arm lets go. Steel tubing is put under a "flat-ride" car to skid it along if an axle breaks.

Everybody Gains from Safety Gadgets

The precautions pay off in more than safety for the customers at a single park. Changes that men like Jim Onorato, general manager of Steeplechase, insist on making receive the blessing of the insurance companies. The insurance companies promptly trot around to all the owners of similar rides and "suggest" that they incorporate the changes. They seldom refuse.

Safety, in the end, rests with the carney and park owners, concessionaires, and insurance companies. It's not good business to have accidents. Of the 12,000 to 15,000 American communities that harbor carnivals each season, only a few have officials qualified to pass on the safety of the rides offered.



Thrill ride of 100 years ago was Upside-Down House. Patrons had illusion of looping, but room actually revolved around them as they sat suspended in a bucket that never moved at all.

Permanent parks, on the other hand, get a going-over with a fine-tooth comb from city officials before the start of each season. In New York every ride must be relicensed each year, and every operator must have a certificate of competency.

The insurance companies have a big influence on safety. Rates for all the rides in a given category—say merry-go-rounds—are pooled. If an accident occurs—and operators contend accidents are almost always the customer's fault—it increases premiums paid by *every* owner of a similar ride.

But recently a gentler note has been seen in the amusement ride business—kid rides are growing more and more popular. They are inherently safer because they are slower. All scaled down to the size of the small fry, they include boats, merry-go-rounds, slow-moving airplanes, and even a 14-foot-high roller coaster.

Yet people everywhere enjoy sticking their necks into imaginary danger. Over in India is a rajah who has placed an order with a West Coast manufacturer for an "Octopus" ride. It's bound to scare the pants off the rajah's subjects—and they'll love it. **END**

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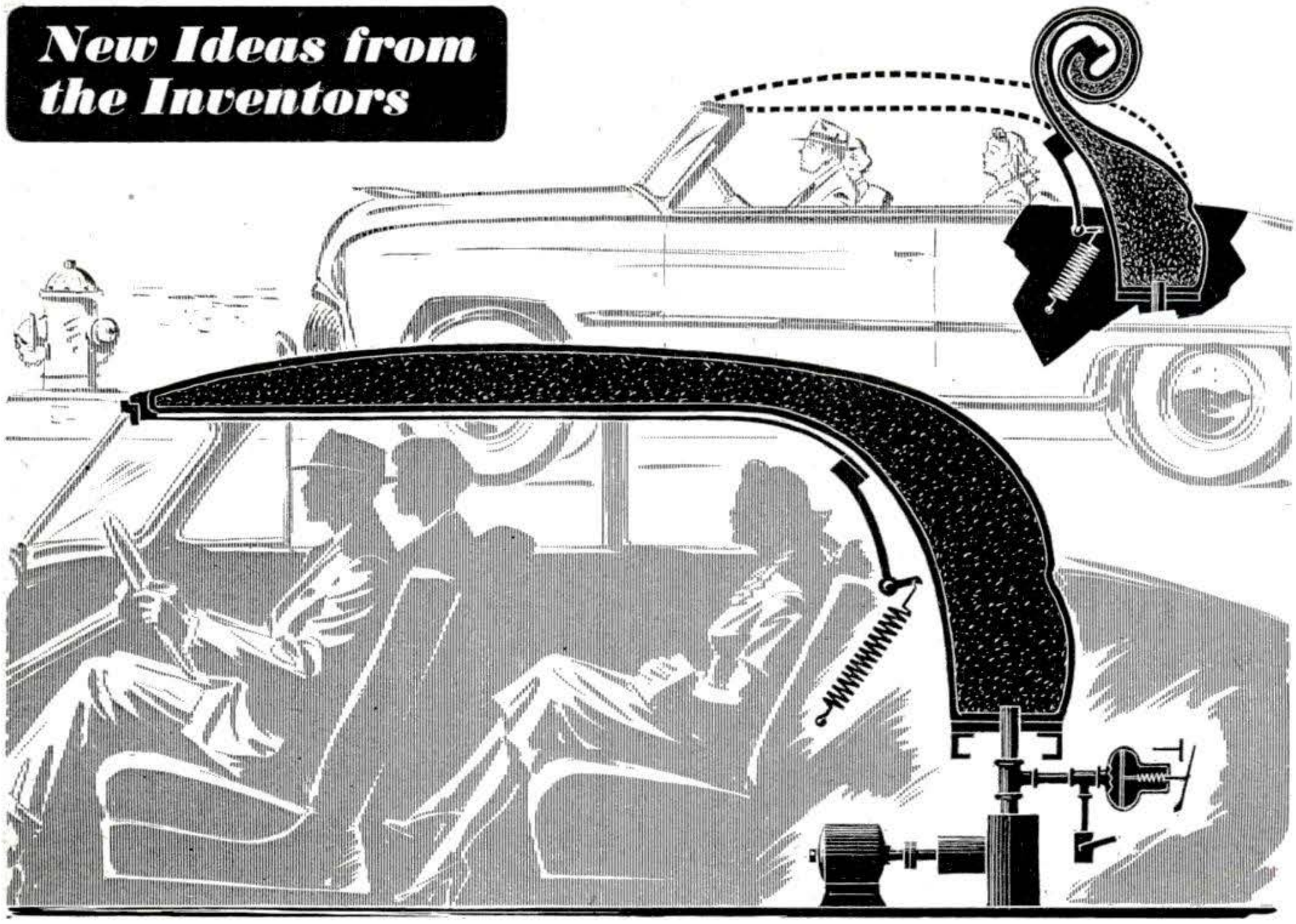
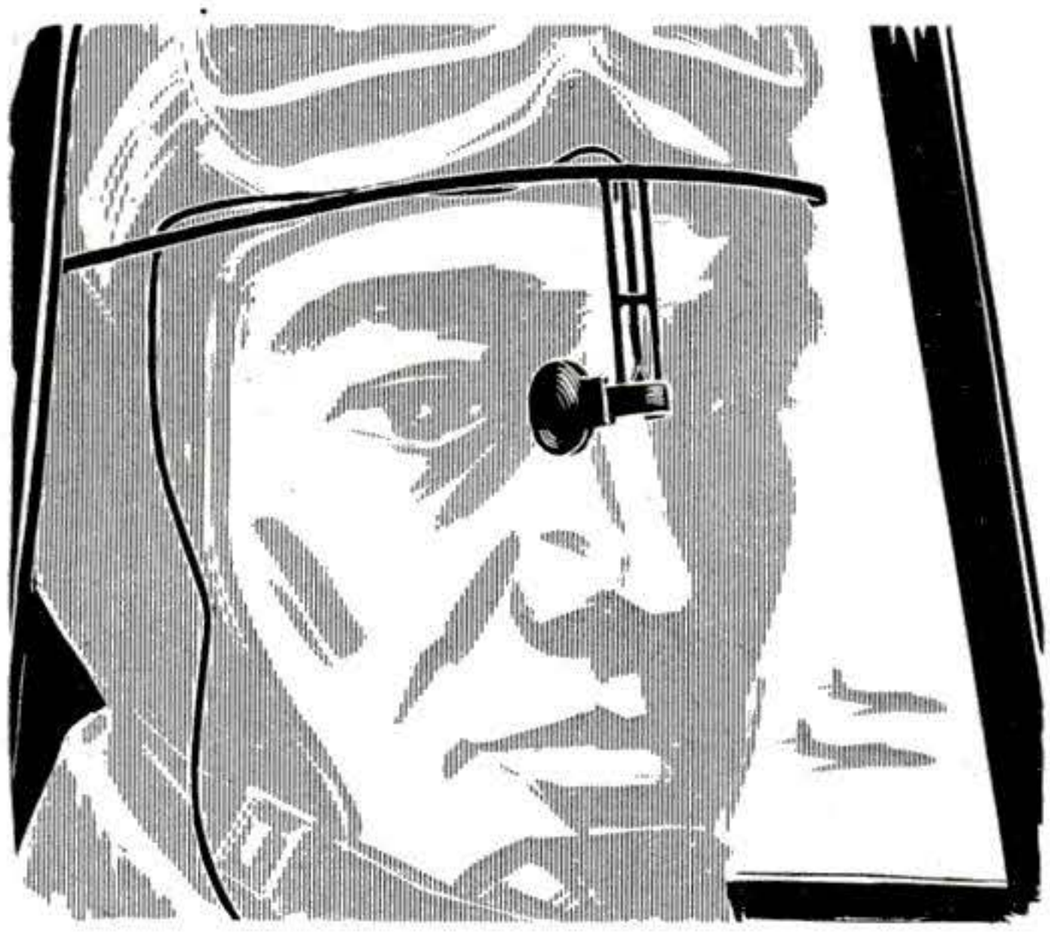
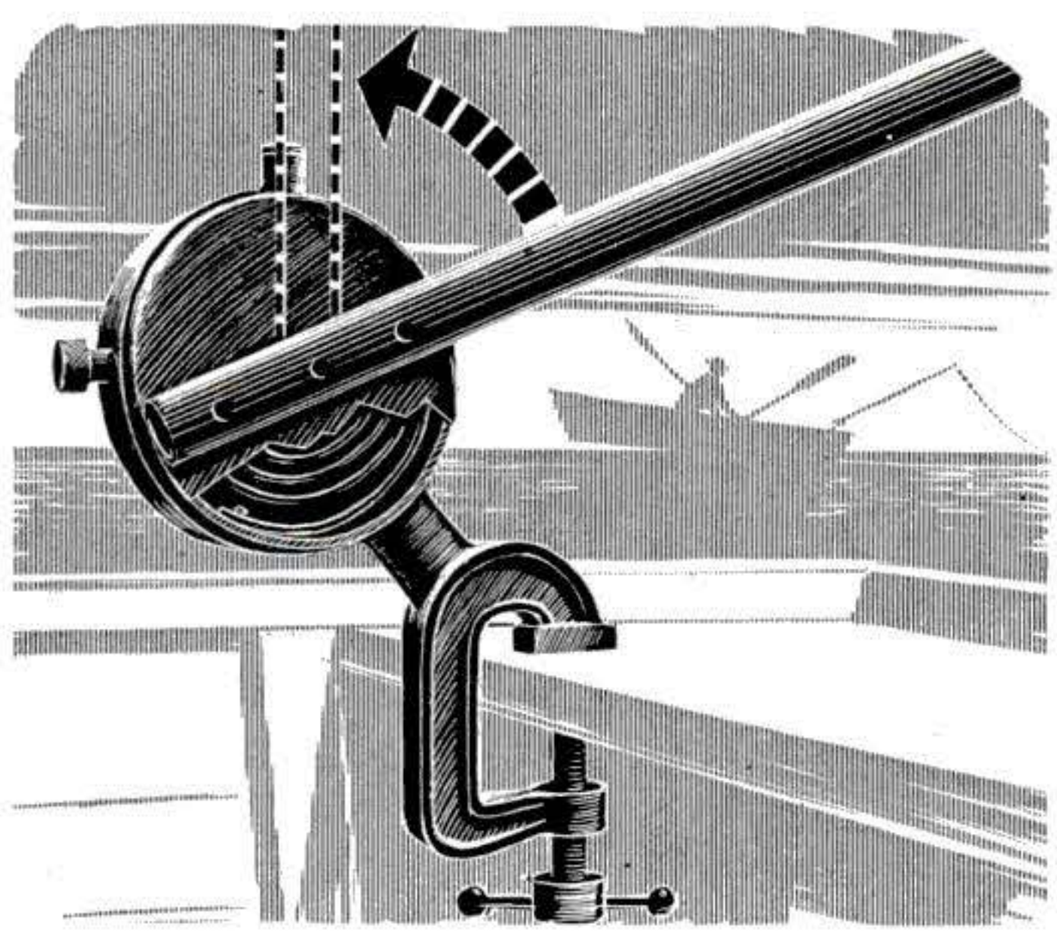
New Ideas from the Inventors



Car Top Inflates. This convertible-car top blows out into place like a paper snake. Let the air out, and long, flat springs running lengthwise along the underside curl up the top and roll it back into a storage compartment. Inventor F. W. Seckel, of New York City, claims that its pressure and elasticity would make it fit tighter than conventional tops. The cushion of air inside the top is said to help insulate the car.



Microphone Fits Nose. This pilot is talking through his nose—literally. His microphone fits over his nose and picks up sound vibrations through the bone. Inventor W. R. Blair, of Washington, D. C., claims it would not only keep out outside noise, but would reproduce speech more clearly than throat-type mikes and be more comfortable.



Pole Holder Hooks Fish. This fishing-pole holder would not only hold your pole while you row, but would hook the fish as well. When a fish strikes, the pull trips a catch, and a coil spring inside snaps the pole upward, setting the hook. The pole fits into the tube attached to the spring. The inventors are J. and A. Sus, of Racine, Wis.

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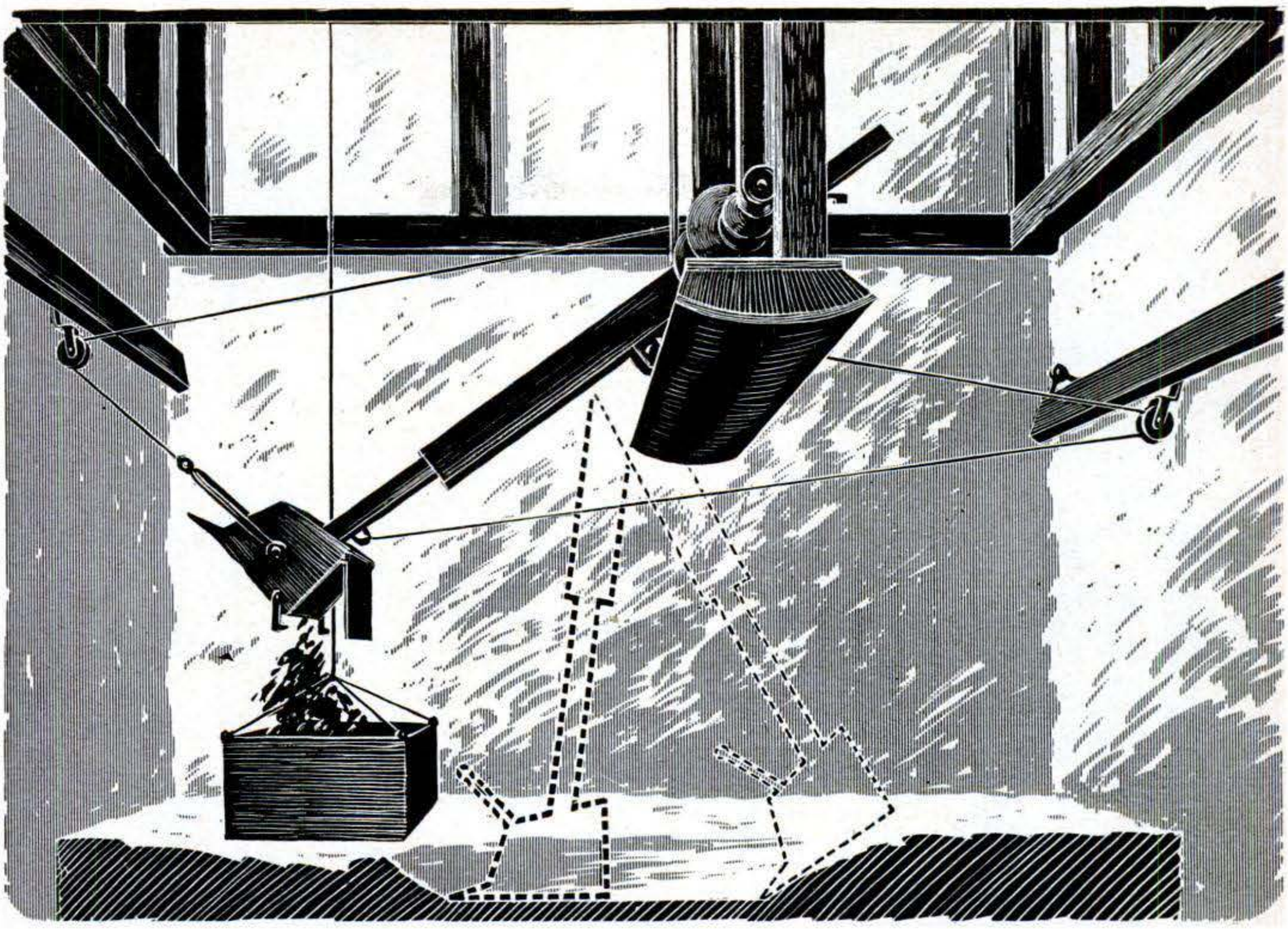
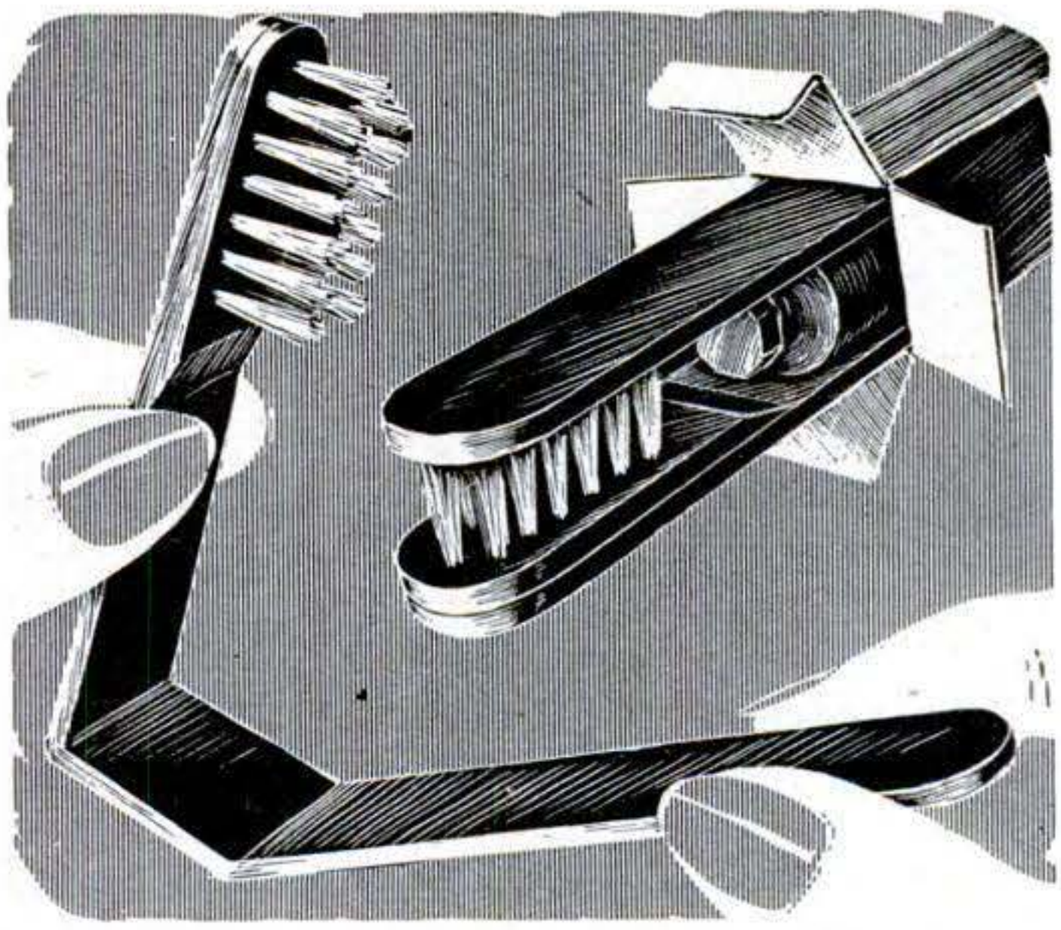


Shovel Digs Mine Shafts. How to get a large power shovel down a small mine shaft is the object of this invention of A. O. Hall, of Wenatchee, Wash. Instead of resting on the pit's cramped bottom, an adjustable-length boom swings down from above, sliding from side to side on an overhead track. The bucket's control lines, running through pulleys sliding in tracks along each wall, move back and forth to follow the boom.



Toothbrush Is Disposable. This cheap, throw-away toothbrush would save your having to buy a regular one every time you went on an unexpected overnight trip. Designed to be used only once or twice, it has a scored cardboard handle that folds in half with space in between for toothpaste. E. M. Curran, of Los Angeles, invented it.

Child's Glass Won't Spill. A small hole in the cap on this glass lets the liquid out, while a second, diagonal hole acts as an air vent. If the glass is knocked over, its elliptical shape rolls it so that both holes are blocked by the liquid. Thus no air can get in, and no liquid can get out. The inventor is B. H. Polcyn, of Milwaukee.

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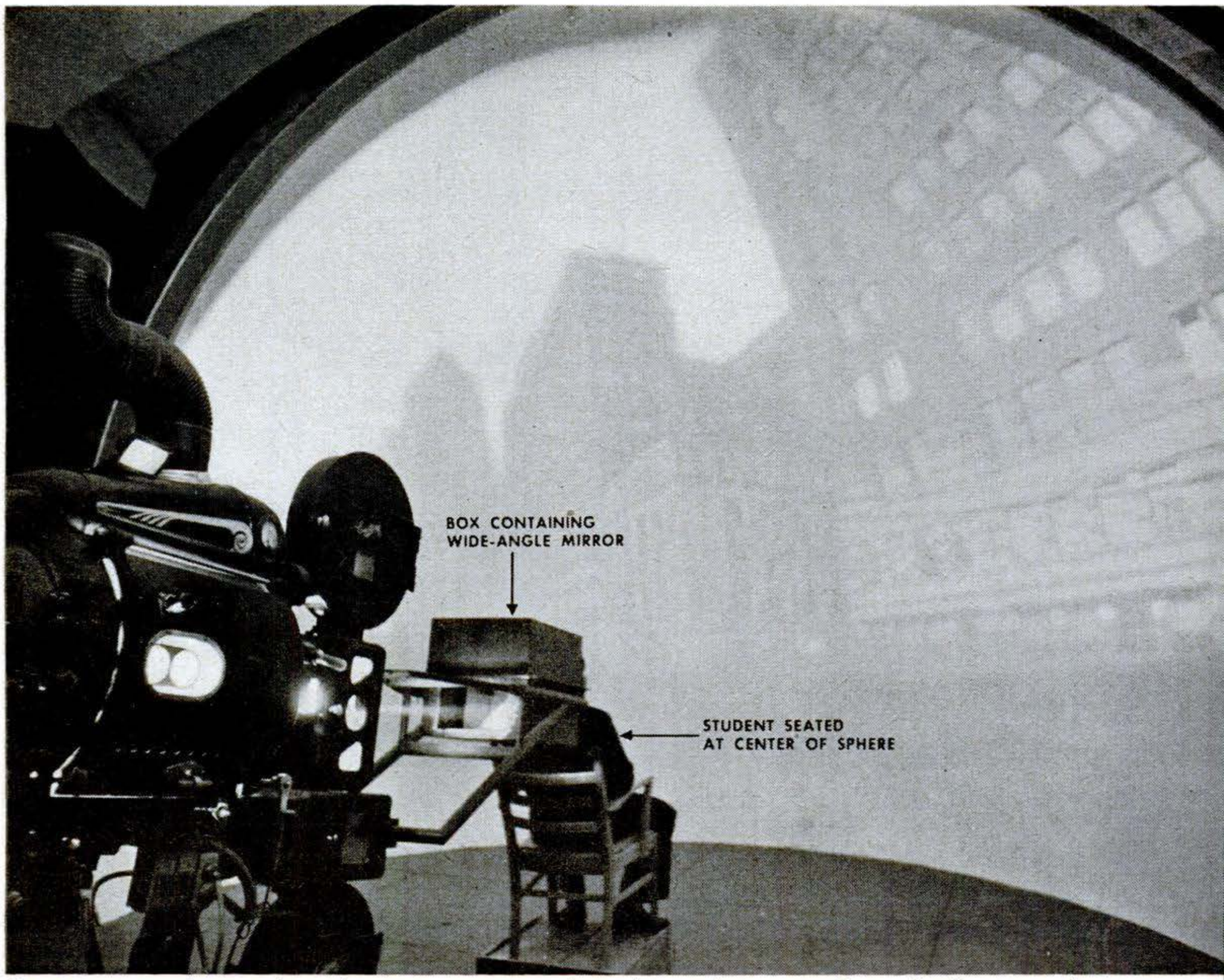

Scene projected on spherical screen appears distorted in PS photographer's view, above; but the student, seated at focal point, the center of the sphere, sees it straightened out.

Trick Mirror Sharpens Air Gunners' Aim

BILLY the Kid was a crack shot when he knew that his victim was coming out through the swinging doors of the Last Chance saloon.

But he might not have done so well if his target had suddenly appeared anywhere along the wide sweep of the horizon or come swooping down from the sky at an unexpected angle. That's the problem faced by an anti-aircraft gunner. To master it takes special training that keeps his eyes constantly alert and covering the vast sky.

Gunnery training devices using ordinary movies on a flat screen lack reality. The camera lens can't catch or project what the wide expanse of human, binocular vision can see. And with a flat projection the student knows the target is straight ahead.

To solve the problem, the Navy's Special Devices Center, at Port Washington, N. Y., worked with the Yerkes Observatory in developing an optical system using a very wide-angle (i.e., short focal-length) mirror that can make 35-mm. motion pictures cover 160° in azimuth and 115° in elevation.

This mirror, of a quarter spherical section, is paired with two flat mirrors that transmit the image to the film. Pictures

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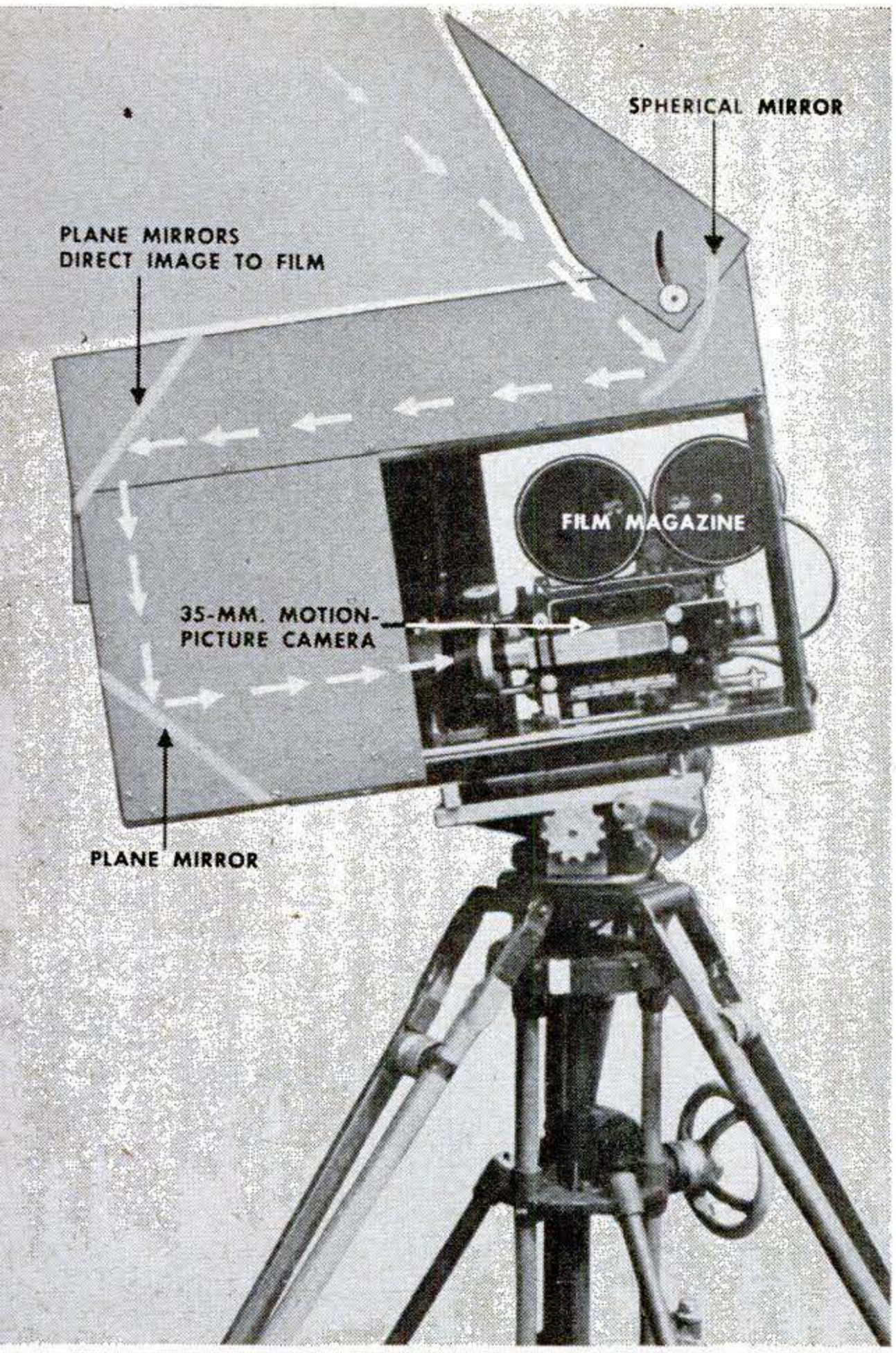
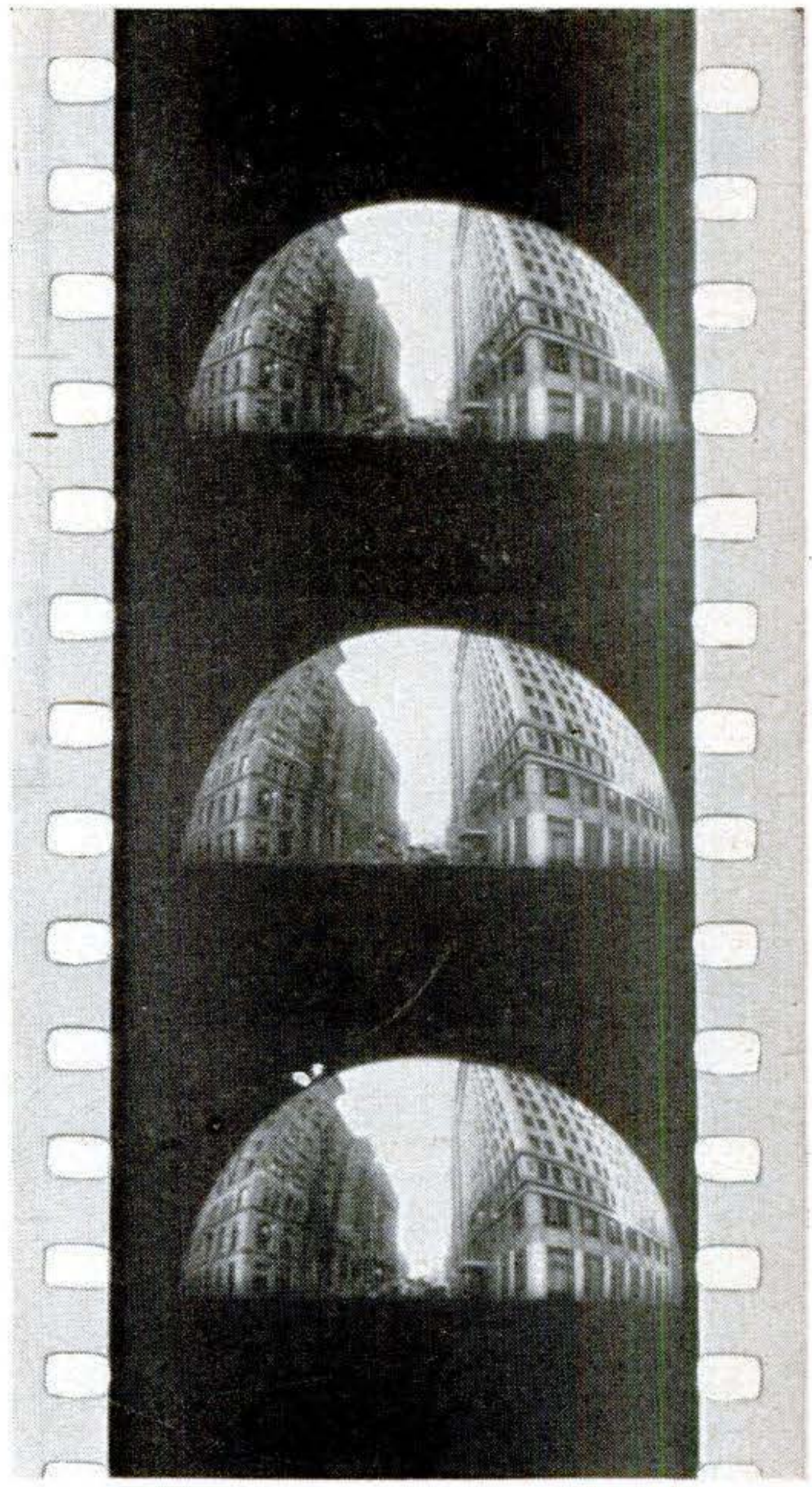
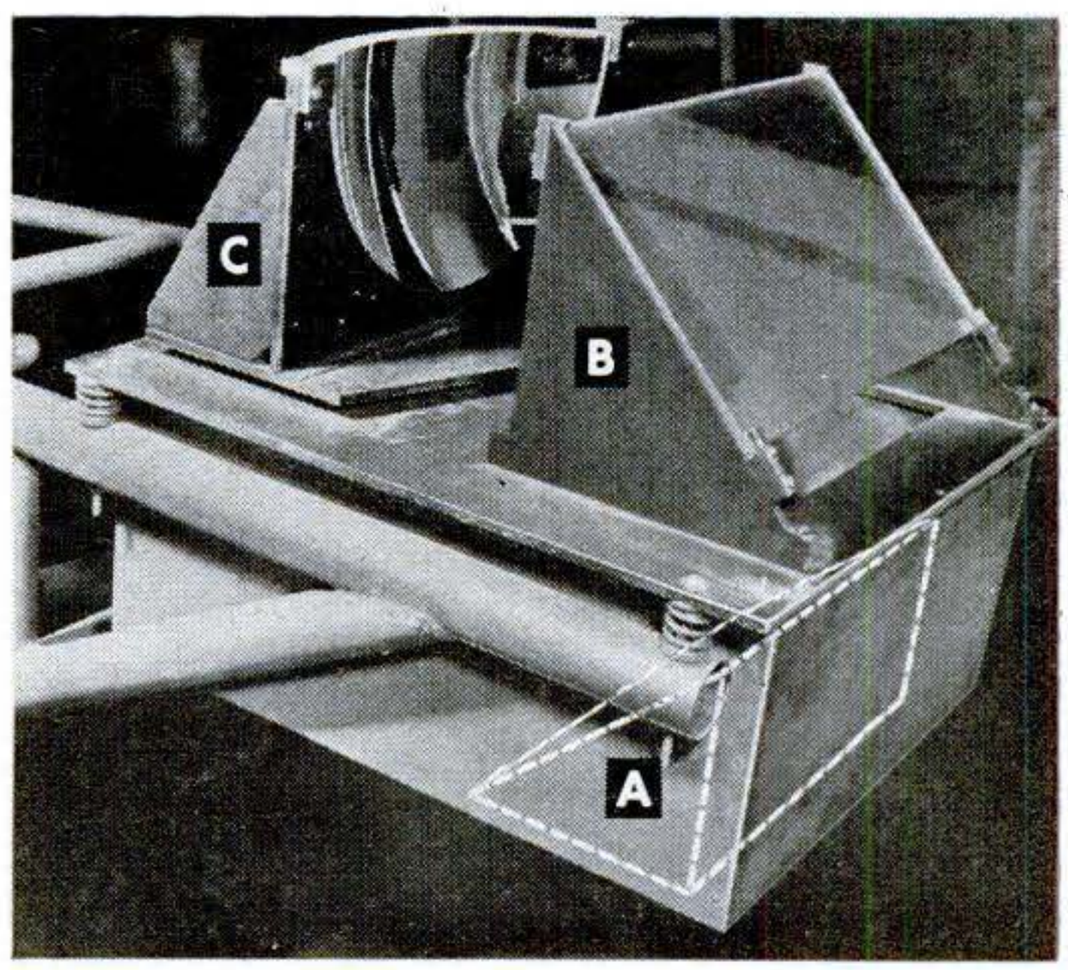




The wide-angle mirror unit in its box is shown here attached to a 35-mm. motion-picture camera. It is the same system as that shown in front of the projector on the opposite page. Strip of film at right demonstrates how views of tall buildings taken with this camera result in accentuated distortion. These "bending" buildings are unscrambled in the projection phase.

taken with the wide-angle mirror are badly distorted on the flat film, just as pictures made with any camera having a very wide-angle lens are distorted in a similar way. But here they are unscrambled by projection through the same lens system on a screen that is a quarter section of a hollow ball. *The distortion, however, is corrected only if the gunnery student sits at the focus, or center of the sphere.* That is why the photo opposite, taken from behind and to one side of the projector, shows so much distortion.

The new training device has paid an unexpected dividend—a strong sense of three-dimensional effect experienced by the student. This is psychological—caused primarily by the expanse of horizon he takes in. But it's the payoff—better gunners—that counts when the going gets rough. END



This uncovered view of the wide-angle mirror system, mounted between arms of the projection machine, shows the arrangement of the two plane mirrors, A and B, and the spherical mirror, C.

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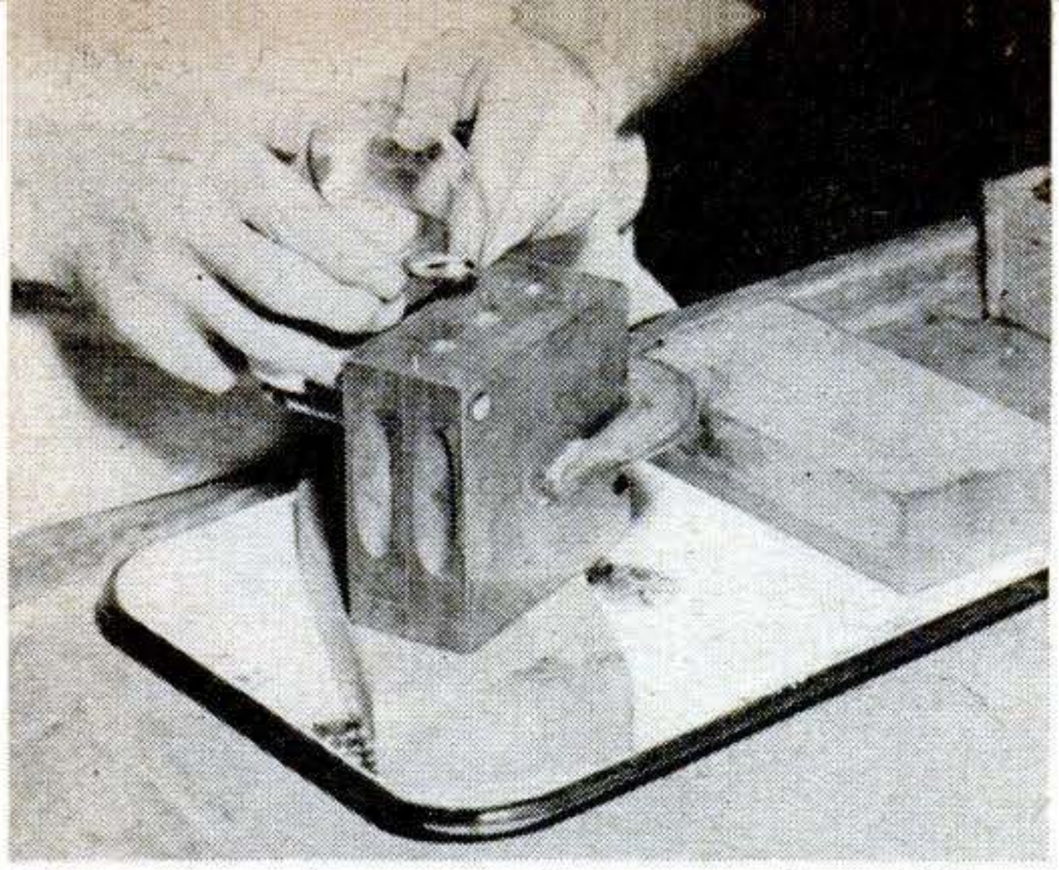
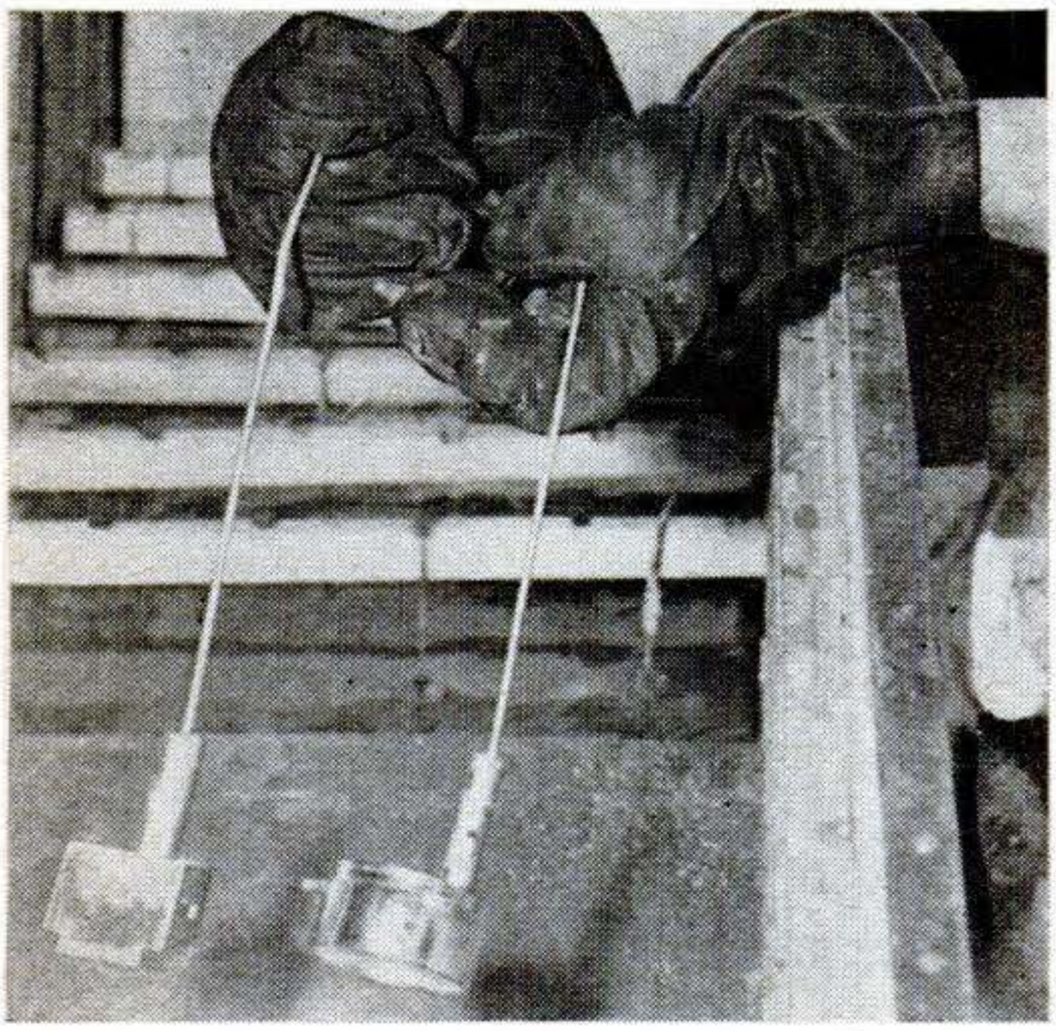


Mercury replaces wax in new version of "lost-wax" casting process. Poured as a liquid into master mold, above, it then is frozen solid in a "cold tank" by immersing mold in a refrigerant.



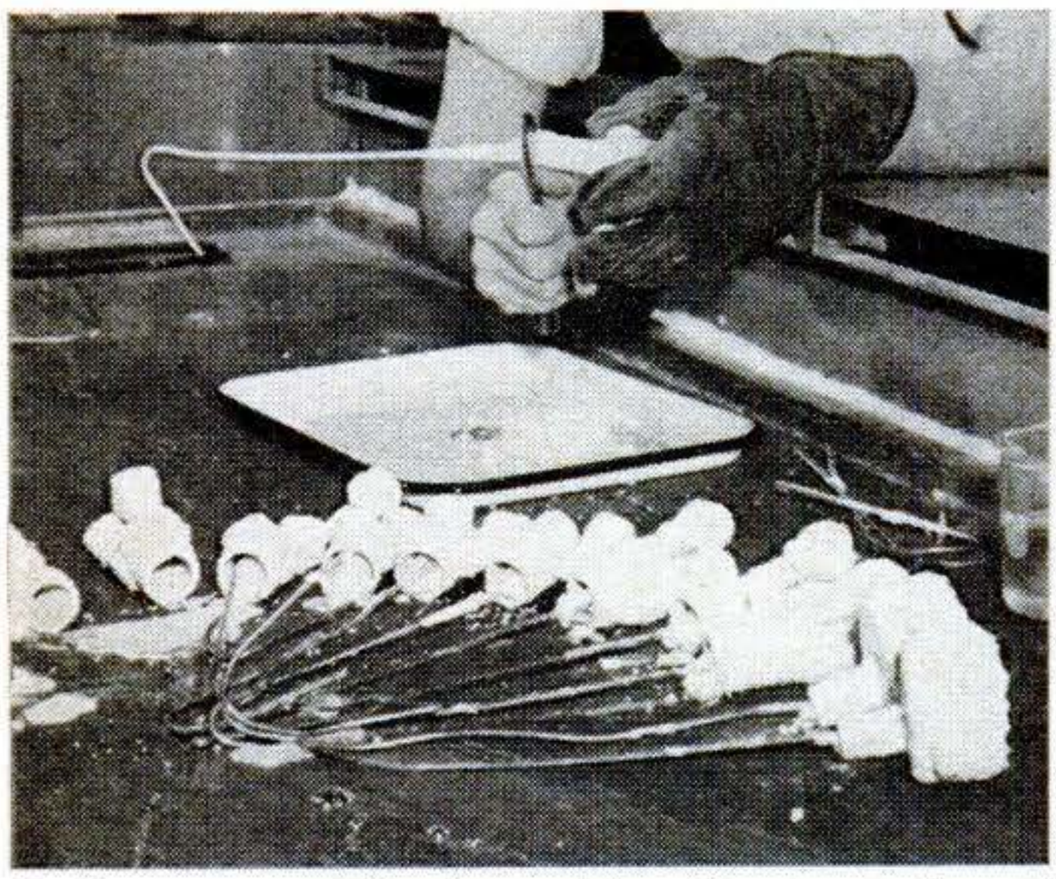
Solid-mercury precision patterns above, removed from master molds, are handled by frozen-in wire rods and kept in cold until used. Frozen mercury looks like lead and is as hard.

Frozen Mercury Shapes Molds

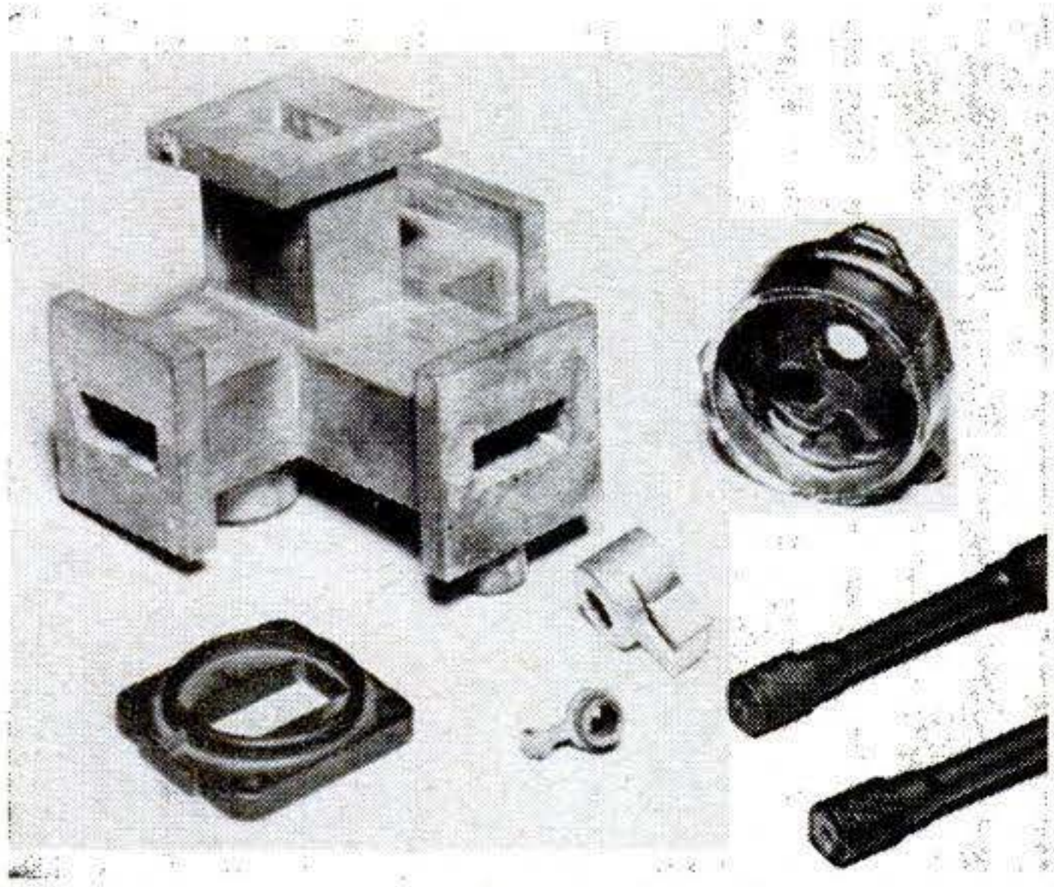
SOLID mercury metal is one of industry's newest and chilliest materials. Made by cooling quicksilver past its 40-below-zero freezing point, it now replaces wax in precision casting. Applied in the Sperry Gyroscope Co. plant at Great Neck, N. Y., the method yields smoother and more accurate parts of aluminum and stainless steel.

Precision casting turns out quantities of metal parts of complicated shape, or of hard-to-machine alloys, with the advantage of a minimum of machining. The standard, time-honored "lost-wax" process duplicates a steel or brass master pattern by making, first, a master mold and, then, individual patterns of wax. Next, these are coated with refractory material, and the wax is melted out, to make individual molds. Molten metal is poured into these molds to cast the parts, which are recovered by breaking away the molds. The patented new Mercast® process follows the same principles.

Filled with liquid mercury, the master mold goes into a fluid refrigerant chilled with dry ice to -76° F., yielding a solid pattern of frozen mercury. Taken from the mold, this is dipped in a similarly cooled liquid mix of refractory material, which dries and hardens around it to form the final mold. Then the mercury is allowed to melt and run out. It is reclaimed for reuse.



Refractory molds, formed by dipping in liquid mix and drying in cold, are cut open and mercury is allowed to melt and run out. It flows down sloping table top to drain for recovery.



Precision castings of complex shapes, above, were made by highly accurate new Mercast® process. In parts up to 1½-in. size, it will hold dimensions within a tolerance of .003 inch.

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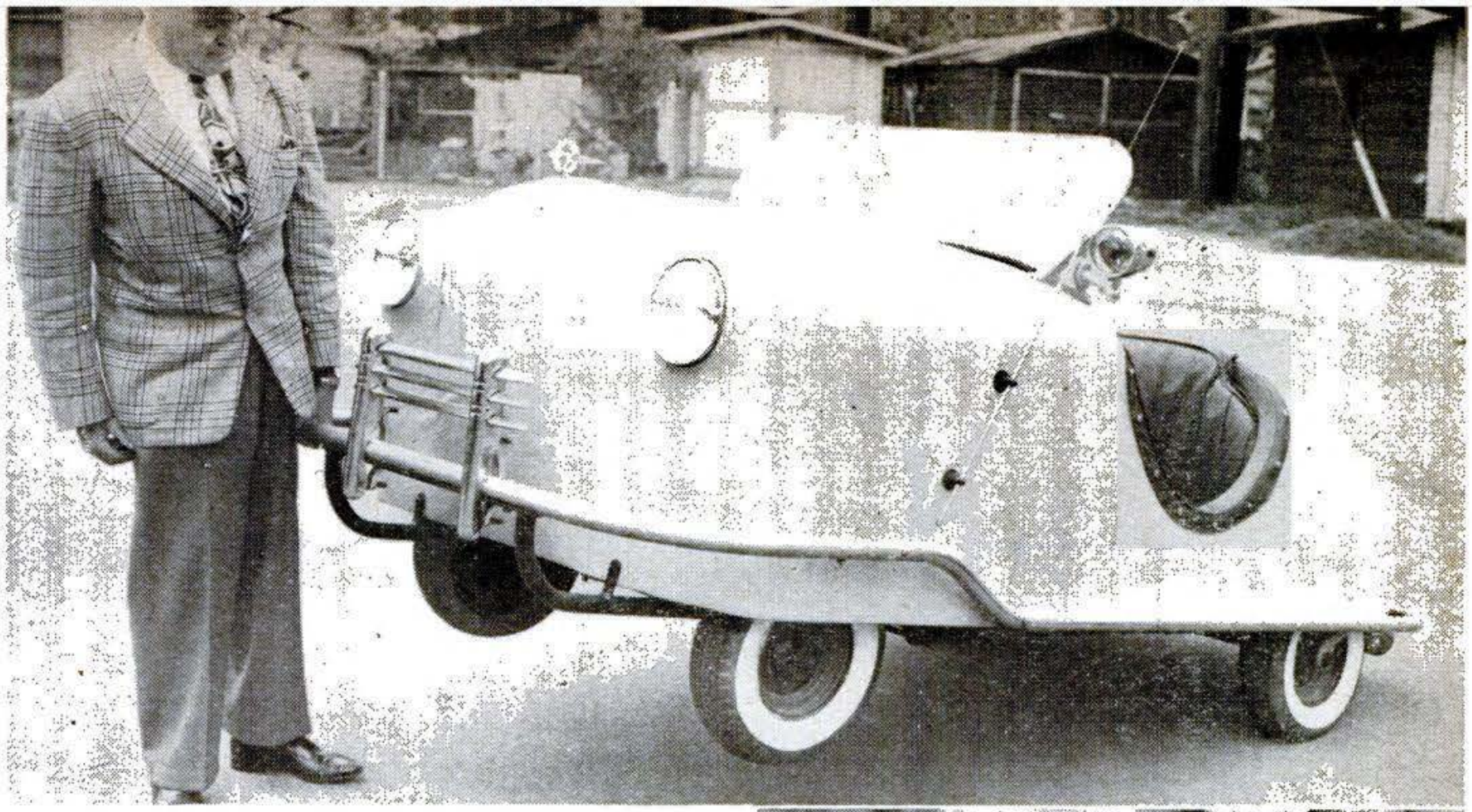
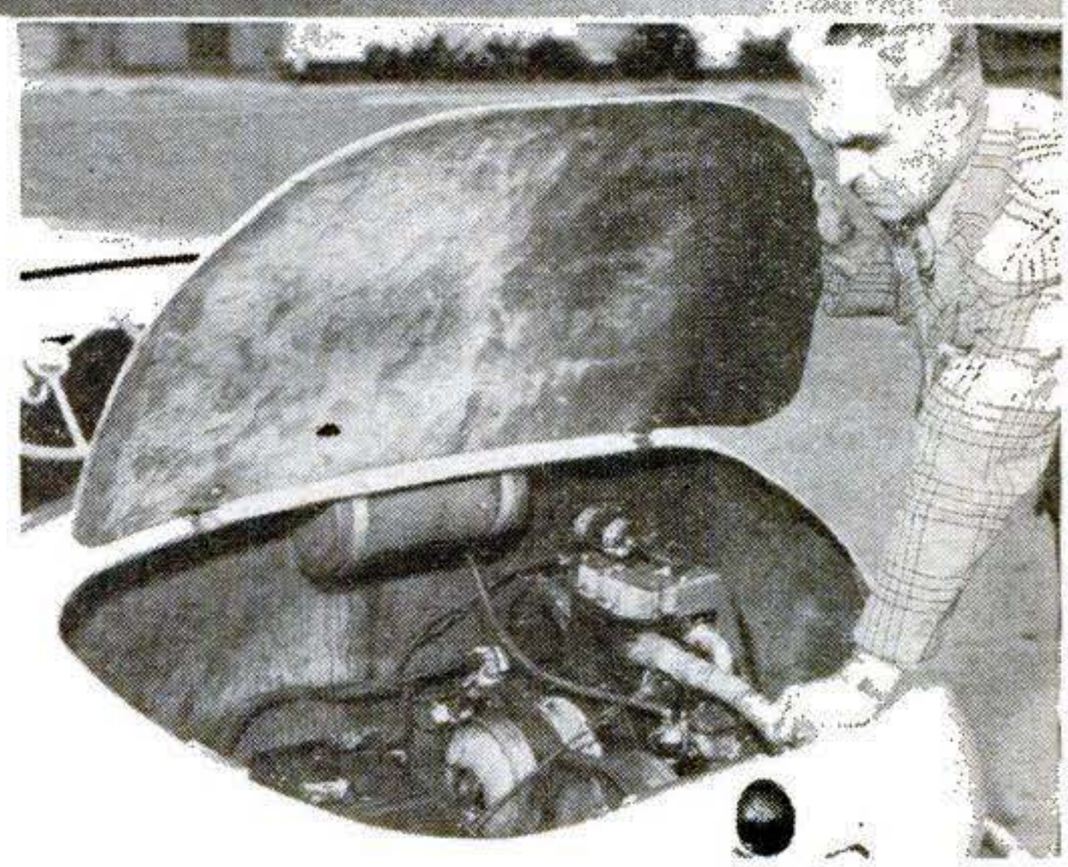
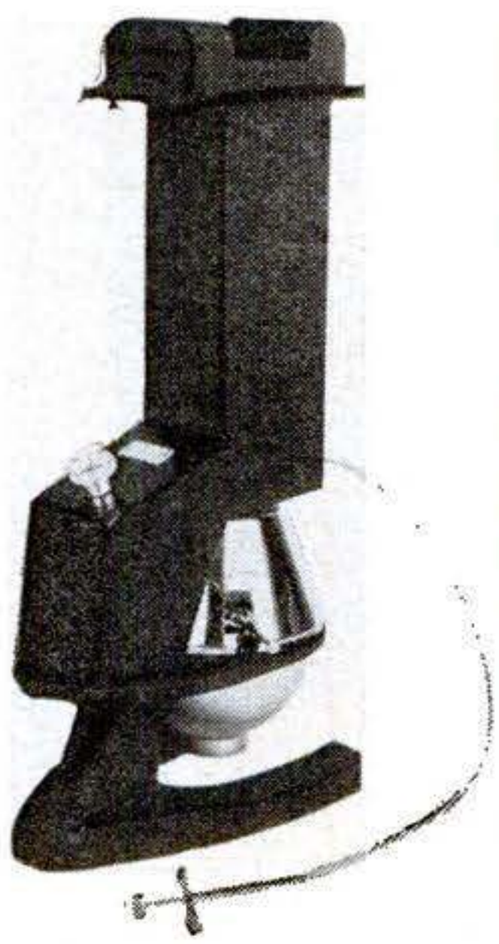
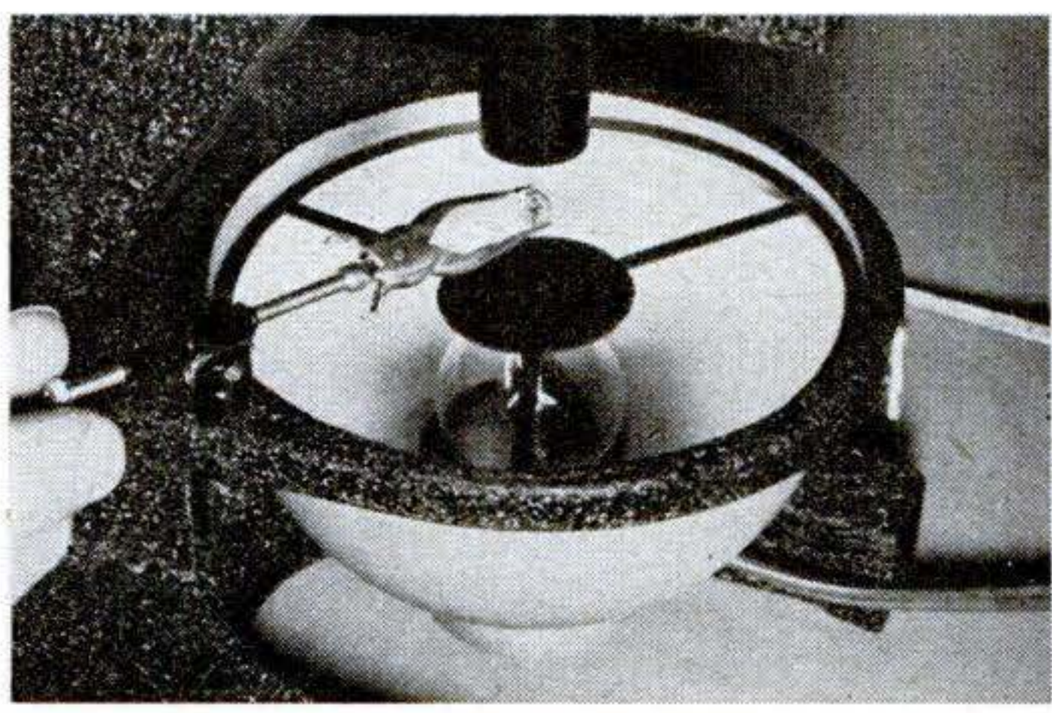


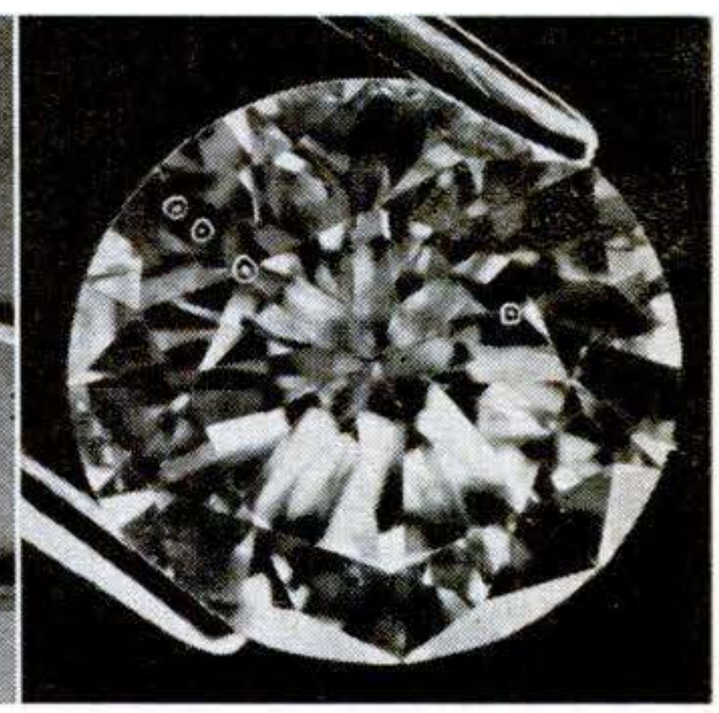
Midget Gets 60 Mi. to Gallon

You can cover 180 to 240 miles on the 3 gallons that fill the tank of this tiny Imp® car. Its rubber-mounted, 7½-hp. Gladden motor (right) gives it a maximum speed of 35 m.p.h. With automatic transmission and chain drive, the car weighs only 475 lb. It has a wheelbase of 63 in., a height of 38 in., and a length of 120 in. A tubular-steel frame and laminated-glass body give the car lightness and strength. The International Motor Products Co., of Glendale, Calif., makes the Imp in one model but in a selection of colors. The little car will cost about $500.









At bottom of micrographic camera (left), gem is held under lens by tweezers (above). Light bulb below gem illuminates it. Photo of circled flaws in gem (right) will become part of record for dealer or customer.

Camera "Fingerprints" Gems

The Gemprinter® identifies diamonds and other precious stones as permanently as fingerprints do a man. A micrographic camera, it photographs the tiny flaws found in gems. Then if a stone is lost, stolen, or even recut, these flaws will always identify it (PS, Aug. '47, p. 120). At the same time, the camera also records the size, weight, flaws, stock number, color, and price, listed on paper in a slot in the side of the instrument. All this information is contained in a 5- by 8½-inch negative. The Gemprinter, made by Gem Instruments, of Los Angeles, for $250, will be leased to jewelers.

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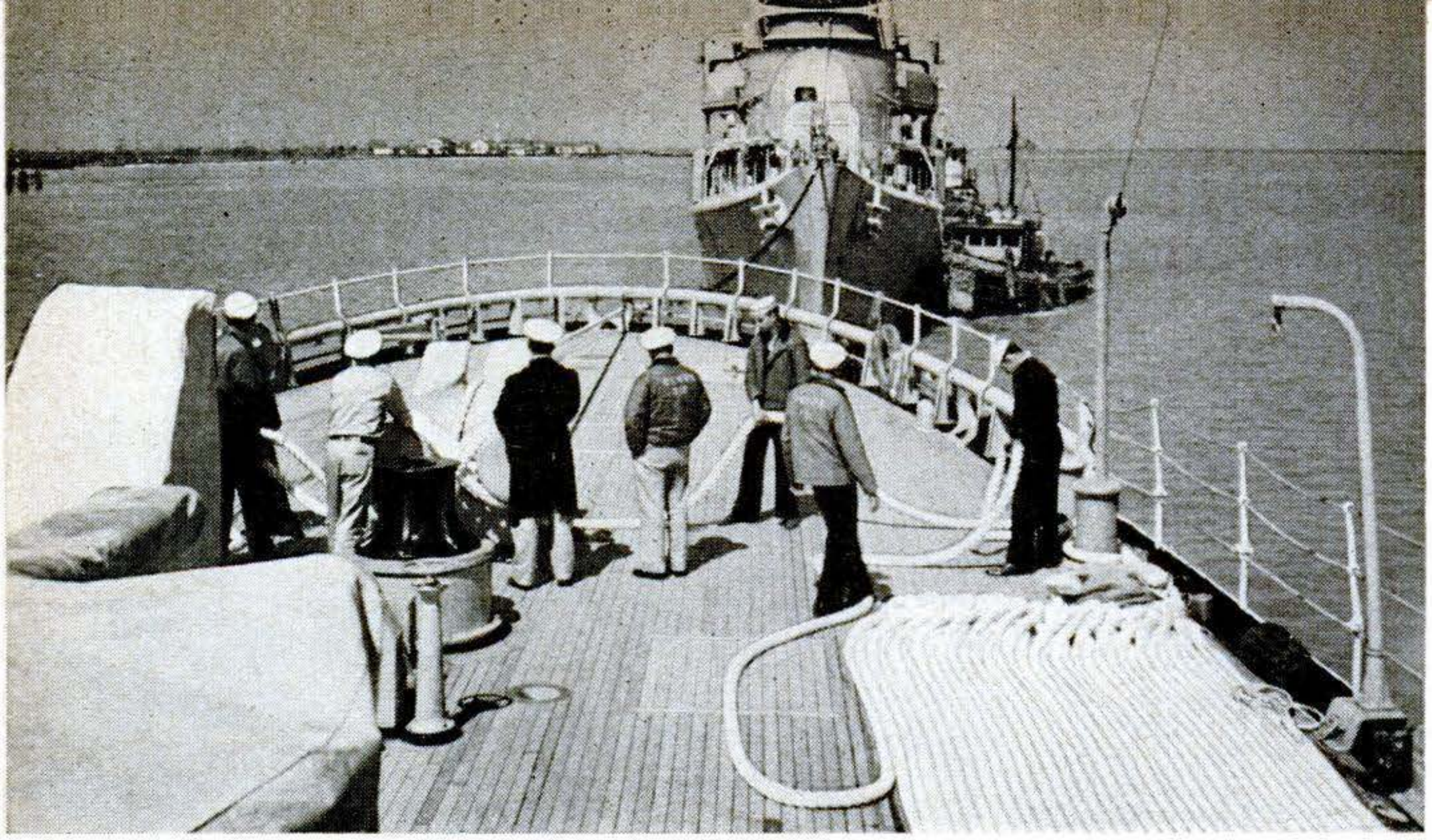


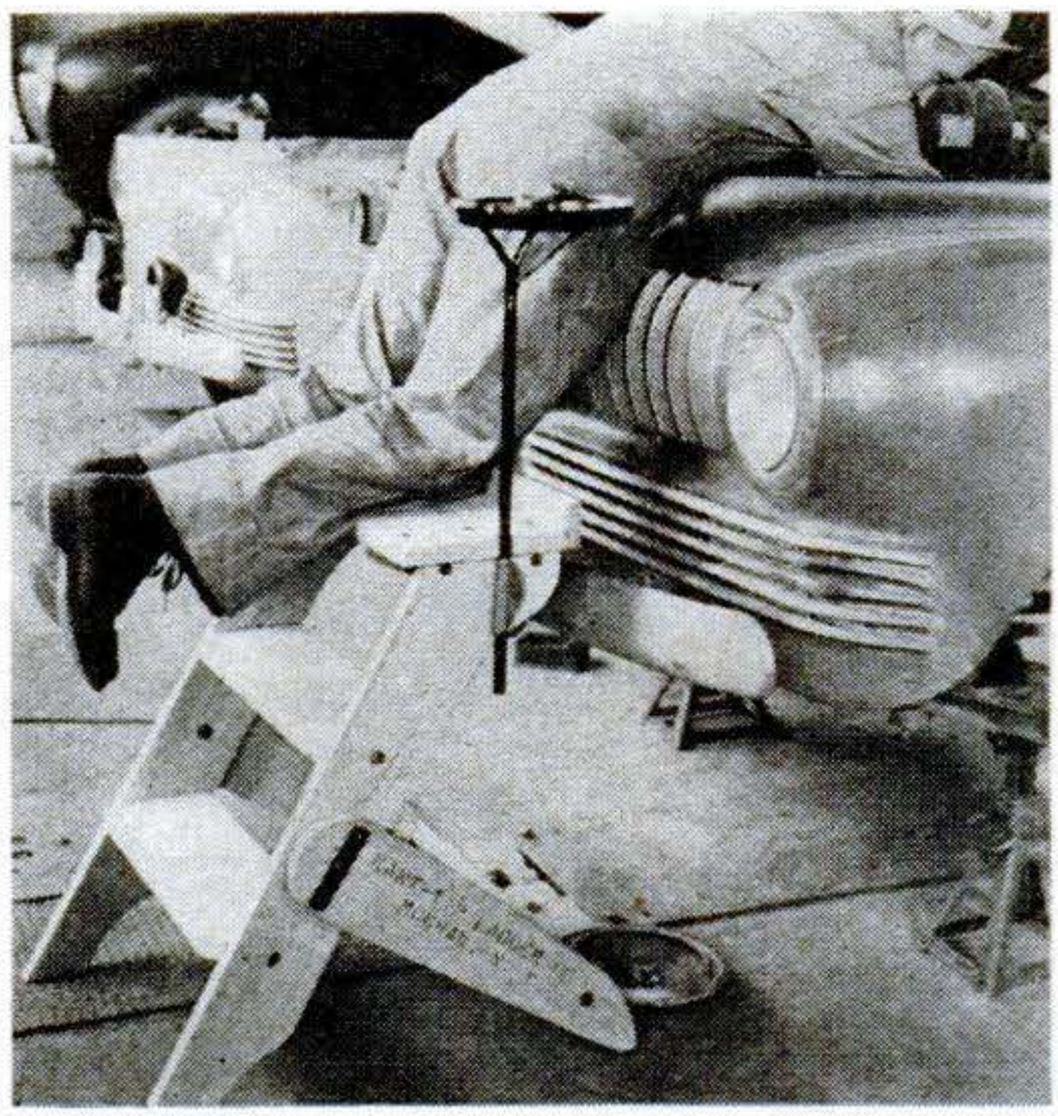
Now Nylon Tows Ships

THERE's enough nylon lying on this ship's deck to make 50,000 pairs of ladies' stockings. But all of it only makes one 1,000-ft.-long, eight-inch hawser, now being tested for towing operations by the Coast Guard.

As strong as a 12-inch Manila line, the nylon hawser is lighter, easier to handle, and stores in half the space. The Coast Guard is trying to learn if its longer life is worth the initial cost, four times as high.

Bazooka Doubles Its Punch

ITS looks haven't changed much, but this new 3.5-inch "super-bazooka" packs twice the wallop of its 2.36-inch* older brother, used in World War II. The result is to give an infantryman the punch of medium artillery in a package he can carry around with him. A bipod helps steady the rocket launcher for accurate firing from the prone position. The new bazooka was developed by the Army's Ordnance Department.



Ladder Gets Into Tight Spots

GARAGE mechanics can get at tight places on an auto with a new safety ladder, also useful in homes and shops. Its bracing legs, hinged low, slide under a car body, bringing the top step close to the side. This step has a toe board to prevent scuffing the finish, and an adjustable metal tray holds tools. The ladder, which folds flat, can't tip, slip, or slide, reports its maker, The Kant-Tip Safety Ladder Co., of New York City.

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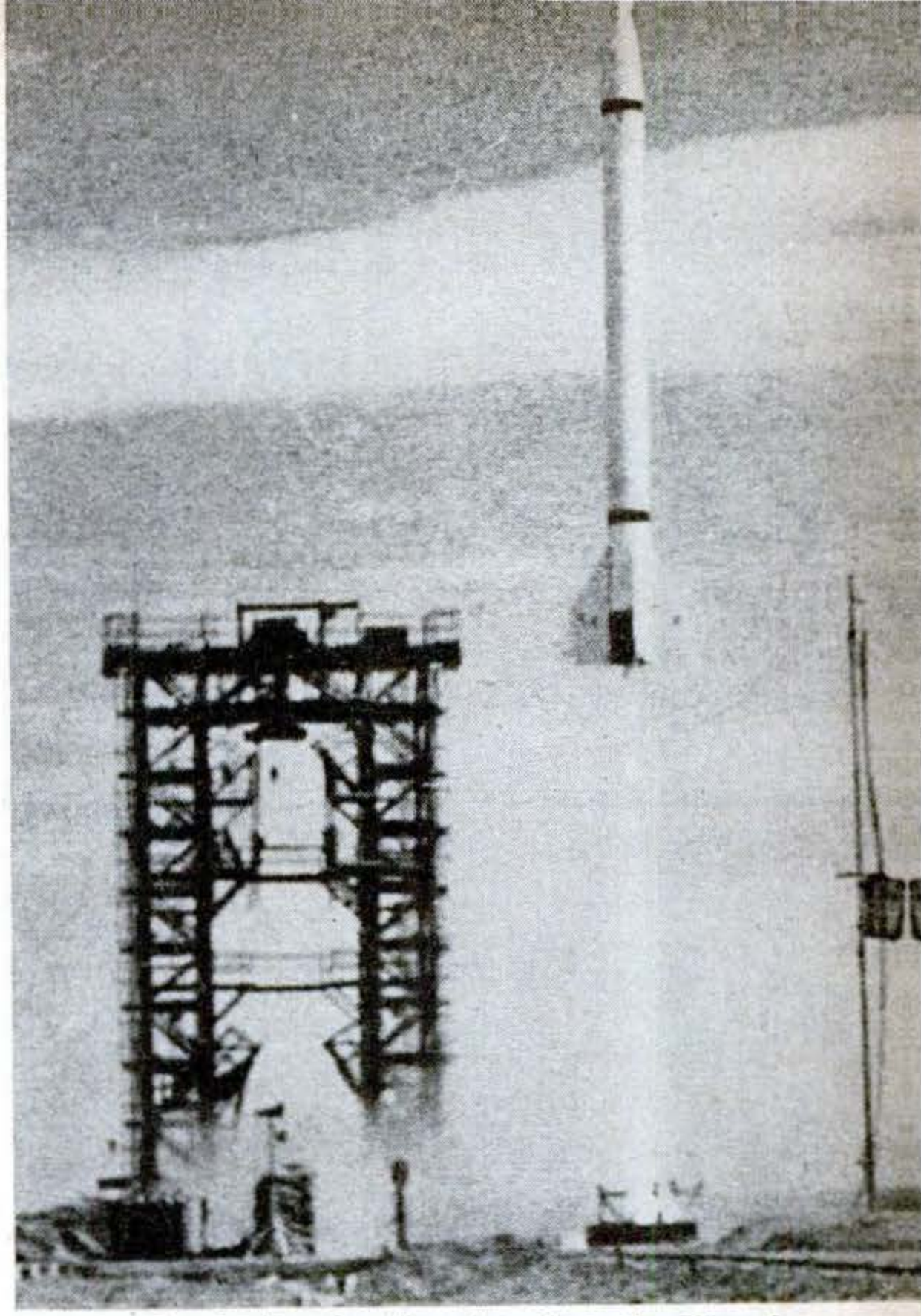
New Rocket Hits 2,250 M.P.H.

ALTHOUGH still operating under wraps, the first of the new high-altitude Viking rockets hit a 2,250-m.p.h. clip on its 51½-mile-high initial flight. This firing was intended to test motor and controls—they worked fine, the Navy said—and did not aim at speed or altitude records.

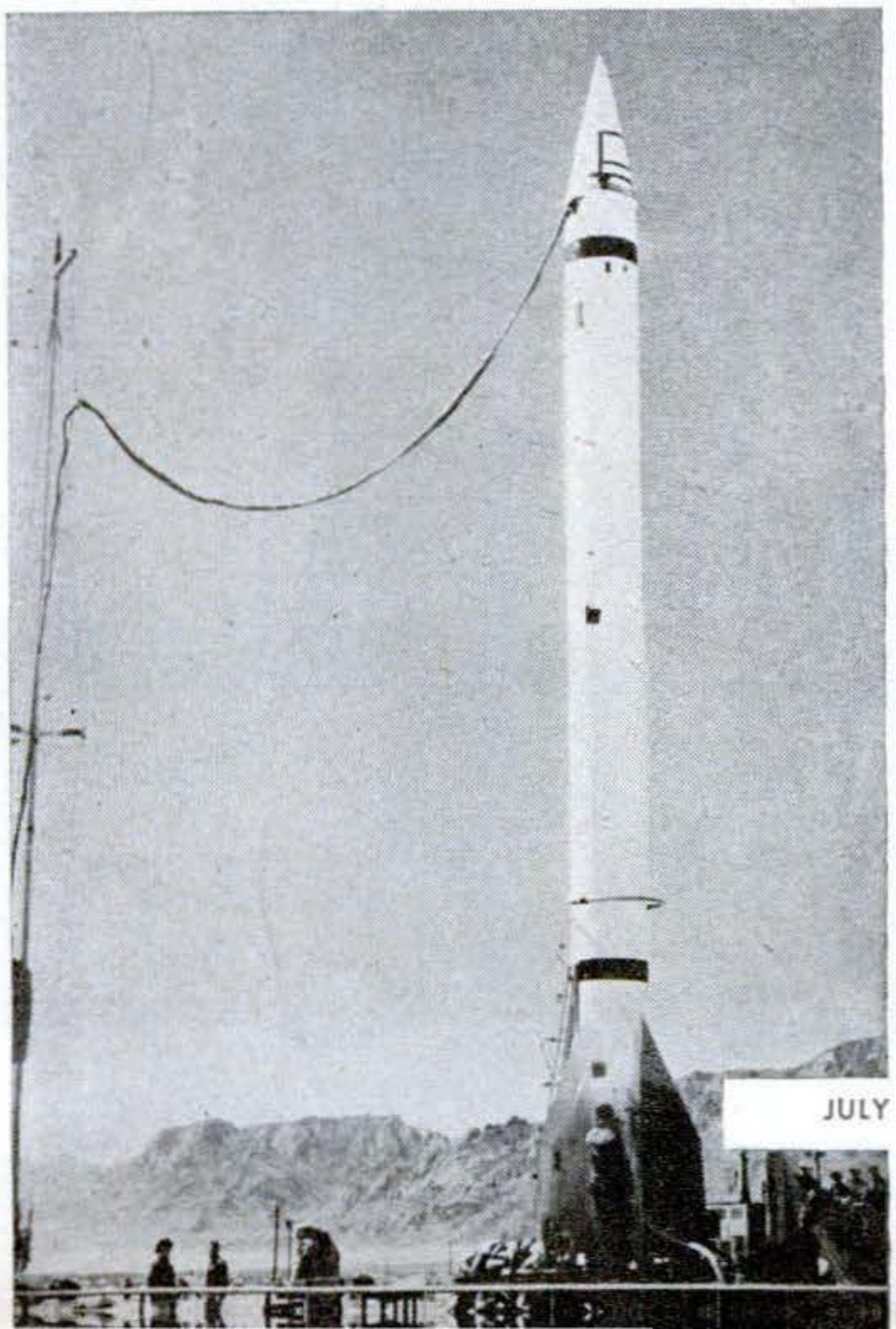
The Viking is being groomed for the job of carrying research instruments as far as possible above the earth, a task now performed by captured German V-2s. It is expected to reach heights of 200 miles or more. (The present altitude record is 250 miles, attained by a V-2 and a Wac Corporal working together; the V-2 holds the speed mark—about 3,500 m.p.h.)

The Viking tested is the first of 10 on order. Weighing five tons fully loaded, the rocket is 45 feet long. It burns liquid oxygen and alcohol, as does the V-2, in an engine that can produce 10 tons of thrust for more than one minute. During flight, pitch, yaw, and roll are controlled automatically. Glenn L. Martin Co. makes the rocket, and Reaction Motors, Inc., Dover, N. J., makes the engine. END

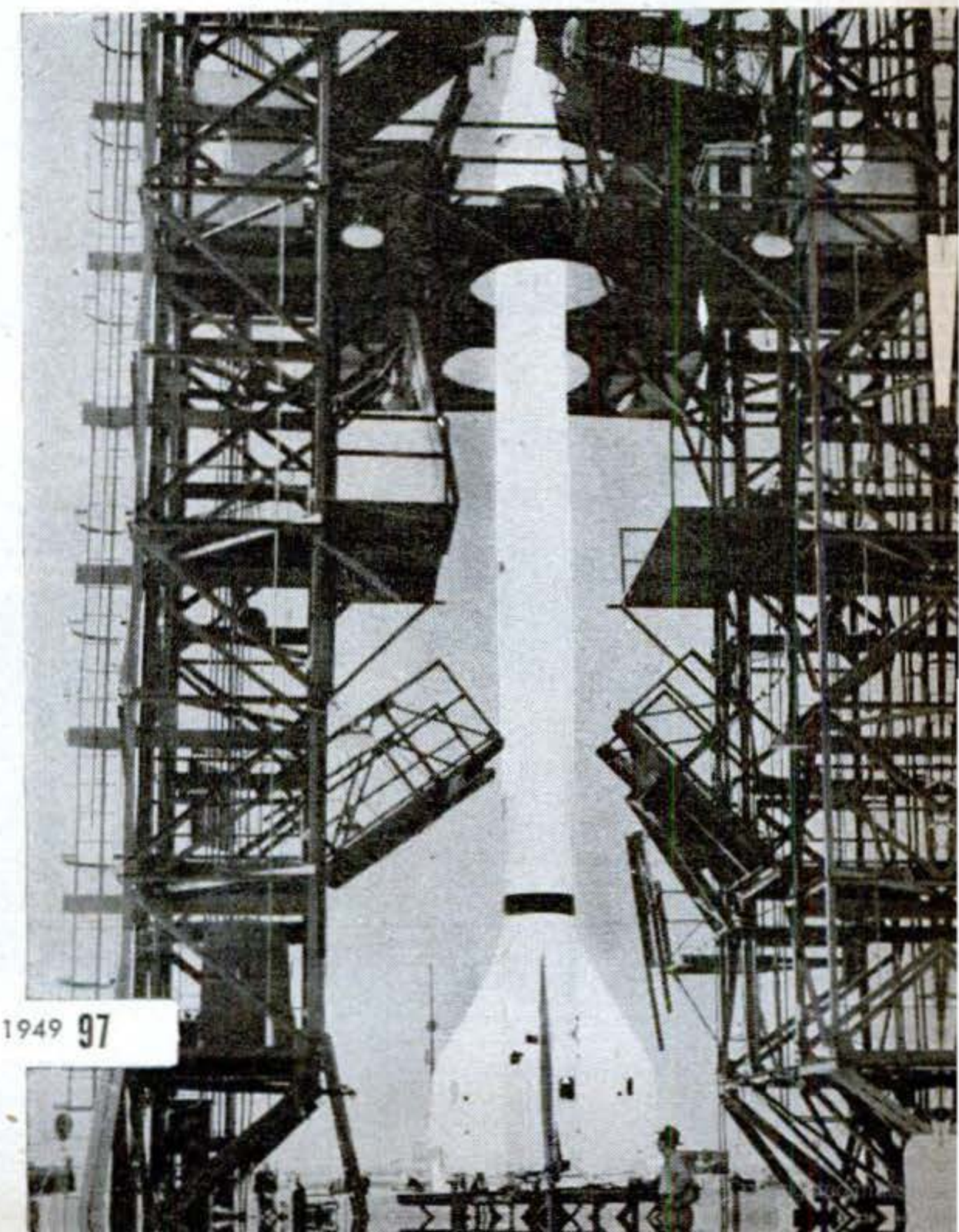


Rising slowly for the first few feet, the Navy's new Viking quickly speeds up to 2,250 m.p.h. on its first flight. It reached 51½ miles in 163 seconds, returned to earth 3½ minutes later.

Last-minute adjustments are completed before test flight of the high-altitude research rocket. It carried some instruments on this trip toward space, and ordinarily will carry even more.



Multi-storied set-up structure, called gantry, is movable. It has drawbridge-like platforms at several levels, providing access to rocket at almost any point along its 45-foot length.



Gas Turbine Drives New Locomotive

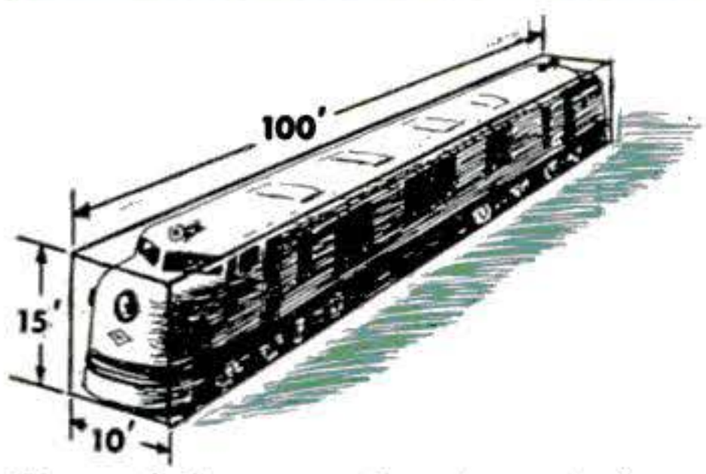
Now starting freight runs, it tests skill of designers in squeezing new power plant into old pattern.

By Hartley E. Howe

THIS month a big brute of a locomotive is going to start hauling freight across the hot plains and up steep mountain grades of the Union Pacific. She looks like a Diesel-electric, but she thunders like no Diesel ever built, mixing a steady roar with a high, hoarse whistle. Fifty feet away a man has to shout in his neighbor's ear to be heard.

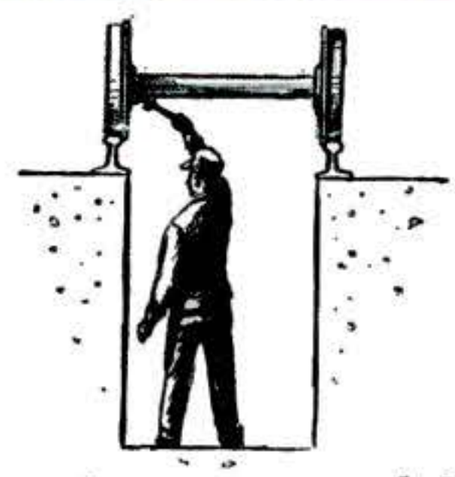
The brute has something to roar about. She's the first gas-turbine locomotive to go into commercial service in the United States. General Electric and the American Locomotive Company have built the new locomotive as part of their search for better railroad prime movers. All designers dream of locomotives that will burn cheaper fuel, produce

SOME PROBLEMS ALL LOCOMOTIVE DESIGNERS FACE

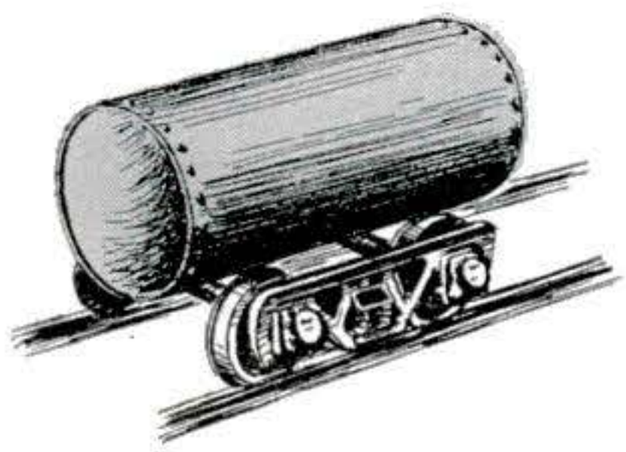


Size of locomotive is strictly limited. Curve radii, shop facilities, turntables, keep length under 100 ft. Tunnels, bridges, limit height to about 15 ft.; tracks, width to about 10 ft.

Load on each axle must be limited to about 60,000 lb. to prevent weight from damaging tracks. For traction, load should also be concentrated on the driving wheels.

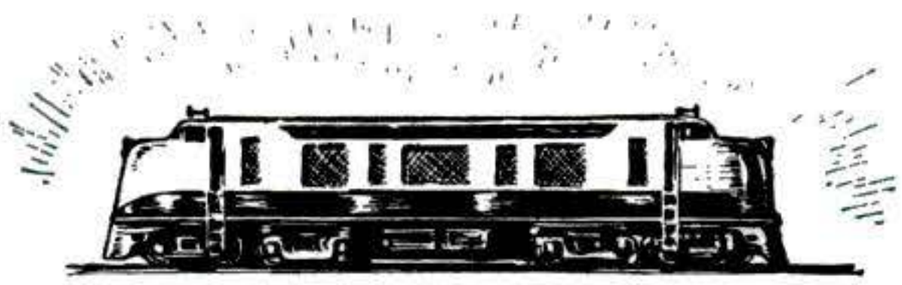


Easy maintenance and long life are highly important, lead to emphasis on simple, rugged construction at expense of complicated designs that increase theoretical efficiency.



Fuel supply carried with locomotive should last for at least 12 hours at full locomotive output to minimize delays on long runs. (Electric locomotives carry no fuel.)

Smooth riding qualities are important both for the comfort and efficiency of the crew and to reduce rail pounding. Reciprocating engines pose biggest problems.



Beauty—modern attractive appearance—is final consideration after all elements have been fitted into chassis. Locomotive should be operable from either end.

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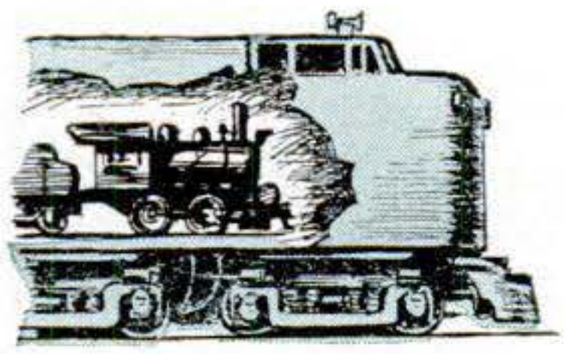
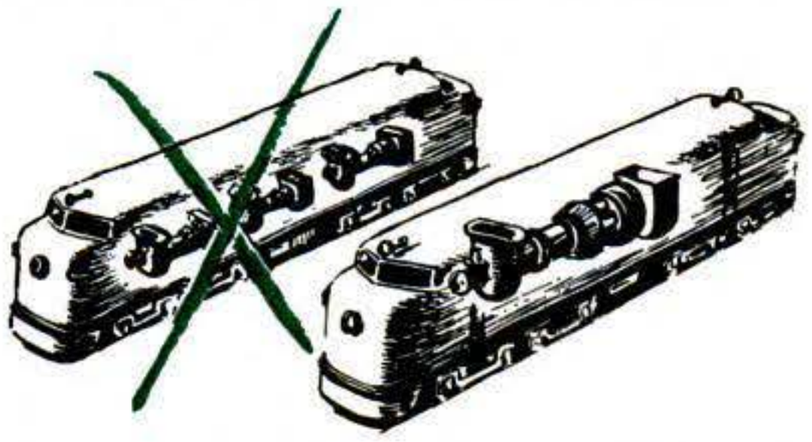
New GE-Alco gas-turbine locomotive sets out for a test run from Erie, Pa. Car immediately behind locomotive carries complicated testing equipment to measure performance.

AND SOME SPECIAL TO THE GAS TURBINE



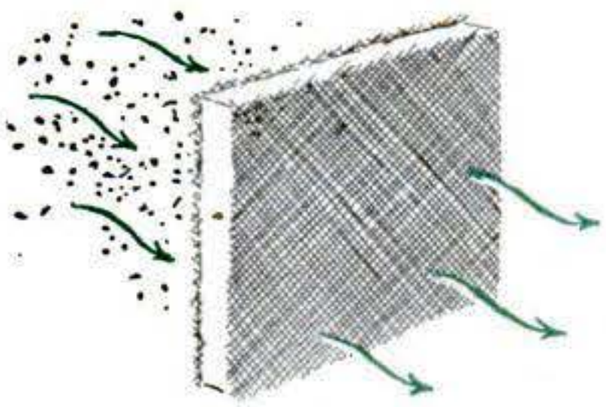
Hostler engine to move gas-turbine locomotive around the yard, like a switcher, is needed because of high idling fuel consumption. The engine also powers the turbine's starter.



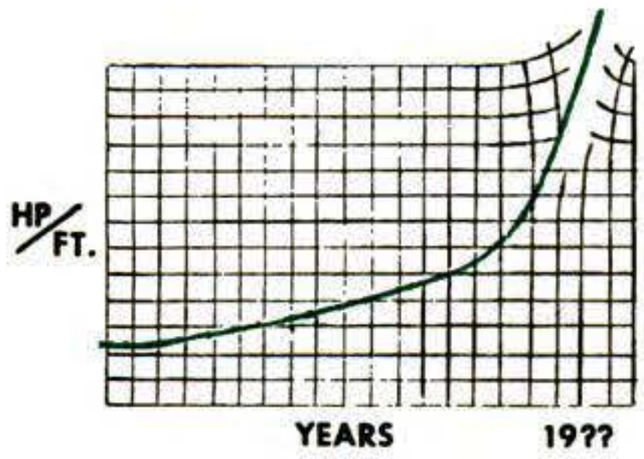
Gas turbines are most efficient when single large units are used instead of several small ones. Locomotive power units must also be rugged, simple in design, long-lived.

Reduction gears between gas-turbine shaft and main generators are needed because of turbine's 6,700 r.p.m. But gears let designers pick best speed for generators.

Fuel must be heated to make it flow properly. This is particularly important because of small openings in tips through which the fuel must be injected into ignition chambers.



Filtered air is needed in large quantities to feed the combustion chambers. Gas turbine does not, however, need air for cooling as do Diesels. Only lube oil must be cooled.



Ratio between horsepower and length is yardstick by which locomotive designers measure success. Horsepower per linear foot has risen steadily for all types.

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more horsepower per foot of length and pound of weight, and be more reliable and easier to maintain. Whether the gas-turbine locomotive will turn out to be the mother of a whole new breed of iron horses or just an experiment depends on how she works out on the job. But in any case she's worth a good long look. You'll see why designing a locomotive is a real art.

Think you just have to pick out a good power plant and put wheels under it? Just recall the last time you tried to squeeze all your vacation purchases into an already full suitcase. That's a faint idea of how you design a locomotive. You can't fit everything in just by building it bigger. Track width and clearances control the width; tunnels and bridges put a ceiling on your cab; curves, turntables, and repair shops limit its length.

You can't just slap wheels under your power plant where you feel like it, either. Carry your weight on too few axles and you put too concentrated a load on your rails. And you must carry your load on drivers, or they'll spin trying to start a mile-long freight.

Twelve hours' fuel supply has to be fitted in somewhere. The engineer must be remembered, too. He's no cowboy: to do his job right he must have a smooth ride. And smooth riding is equally important in cutting the costs of maintaining the right of way.

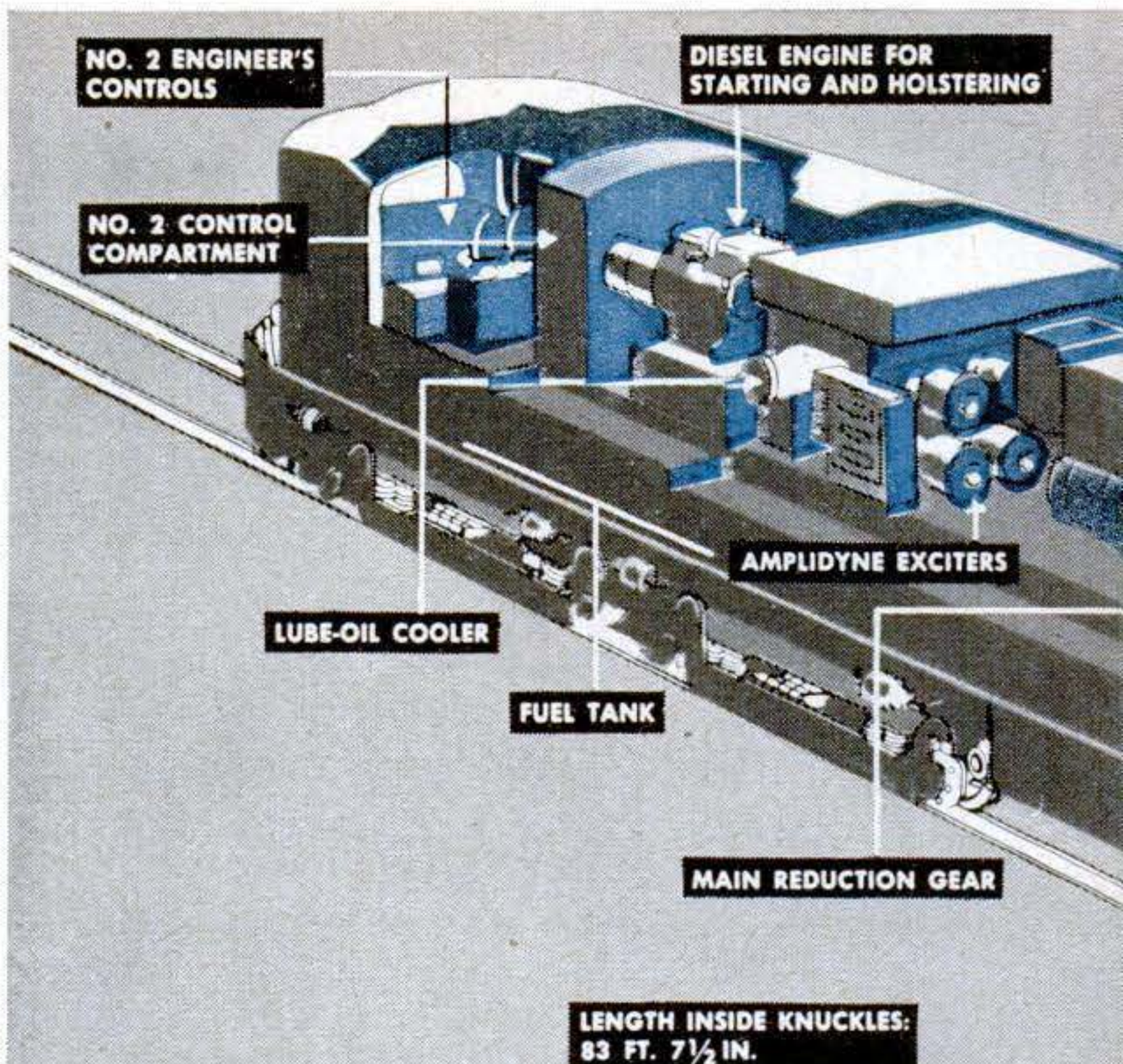
The locomotive must be double-ended, for easy reversal of direction. She must be rugged and long-lived to please your customers' cost analysts. And she must be handsome—to please your customers' sales and public-relations men.

Gas Turbines Pose Problems

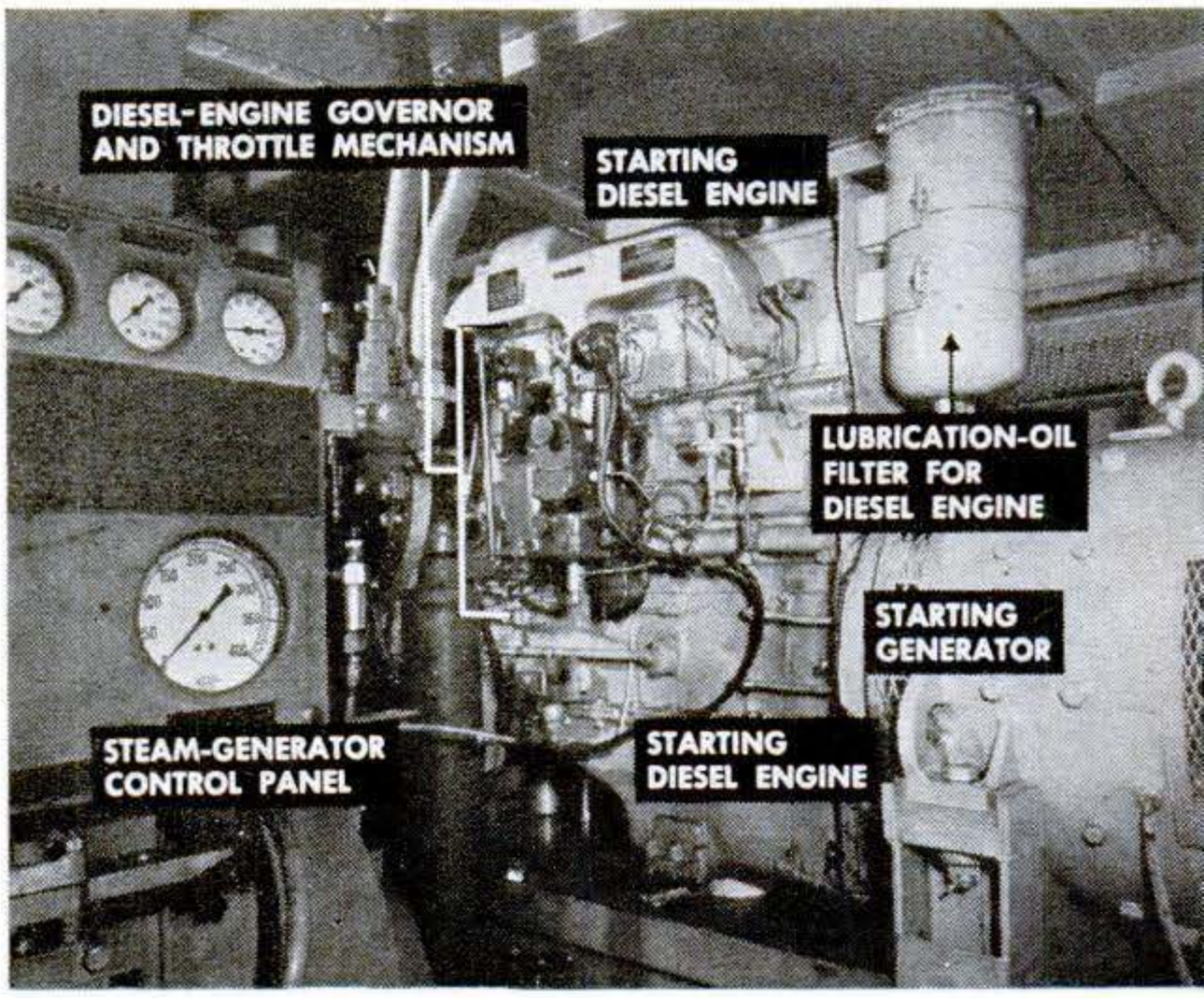
These problems all locomotive designers must face. The men who put the gas turbine on tracks had some extra-special troubles.

They had to take a fly-by-night power plant and rebuild it as a sober, steady citizen of the power world. The gas turbine has been most fully developed to power military aircraft—which are expected to last a few hundred hours. A locomotive measures its useful life in years. Gas turbines, to be efficient, should be used in big, single units. They're hard to start. They need reduction gears. More fuel than ever must be carried, since it is burned so quickly.

Pretty tough problems? You're right. No wonder it took GE engineers five years and some $4,000,000 to make their first gas-turbine locomotive.



How GE-Alco engineers solved problems of designing gas-turbine locomotive is shown in diagram. Two tanks for fuel are built into cab underframe; hold 6,600 gals., enough for 12 hours. Smaller tanks under one end carry Diesel fuel, boiler water for steam generator (hidden in drawing). Steam heats Bunker C fuel through coils in bottom of tank.



Diesel is used for starting and hostlering; the steam generator heats the Bunker C fuel.

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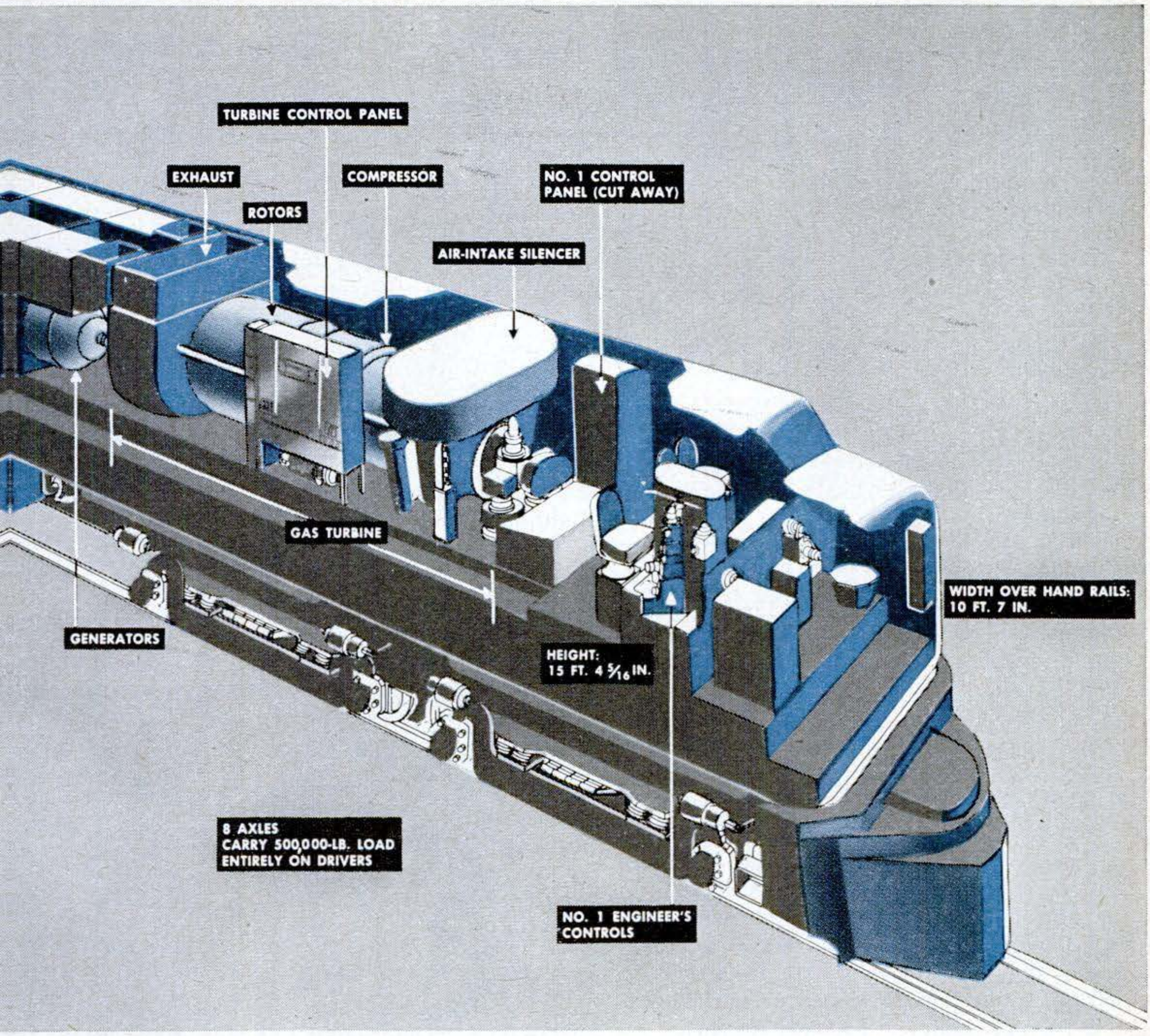

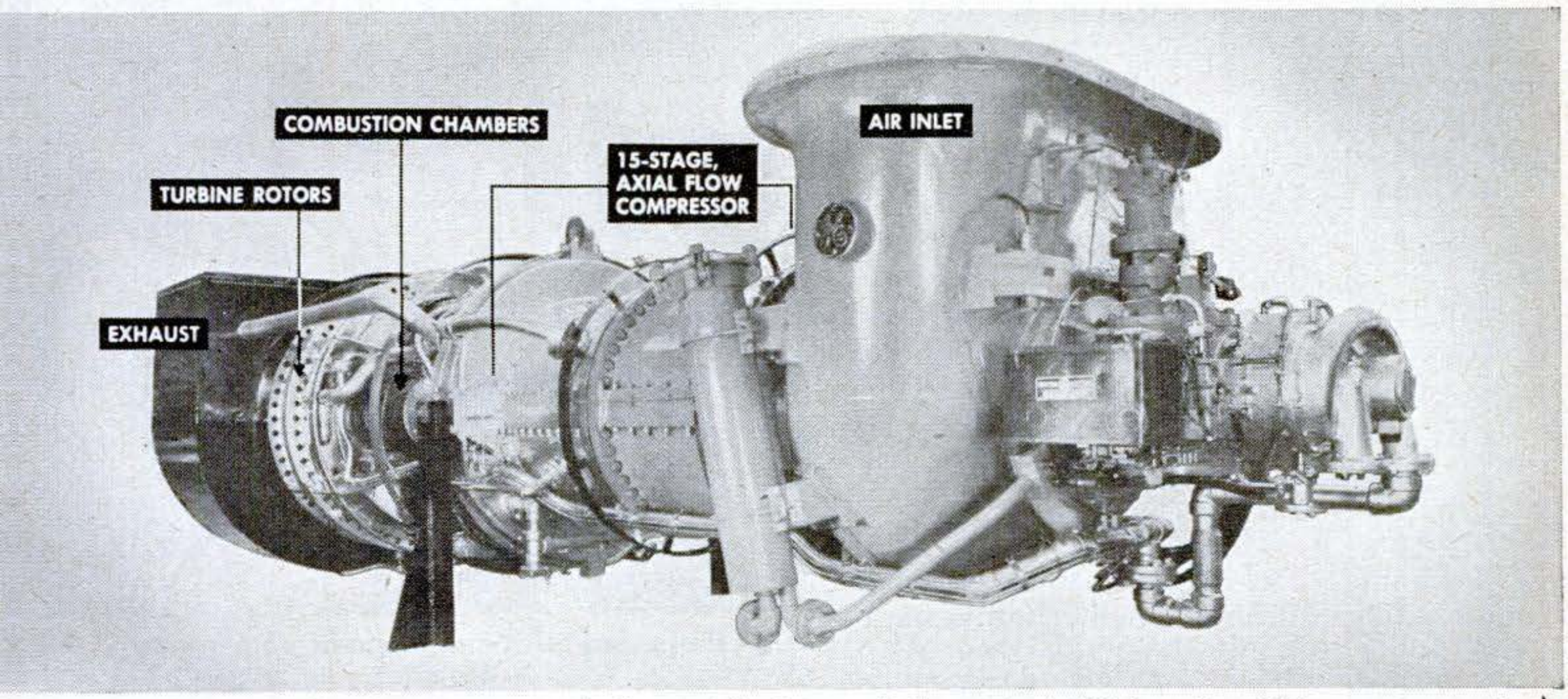

Two-stage gas turbine is 19 ft. long, 6 ft. 8 in. wide. Two thirds of power drives compressor; balance is 4,800 hp., but 300 goes to auxiliaries, leaving 4,500 hp. for the generators.

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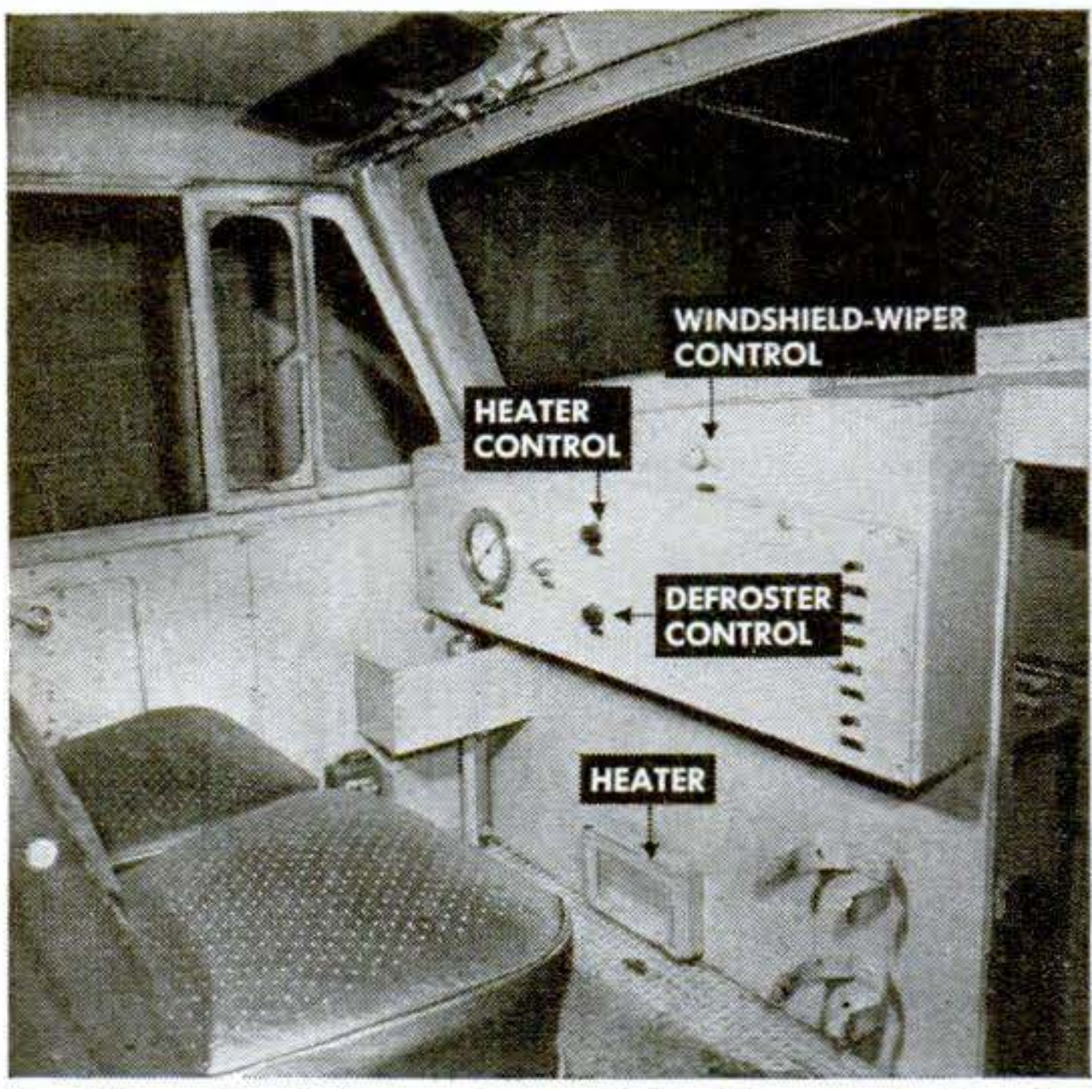


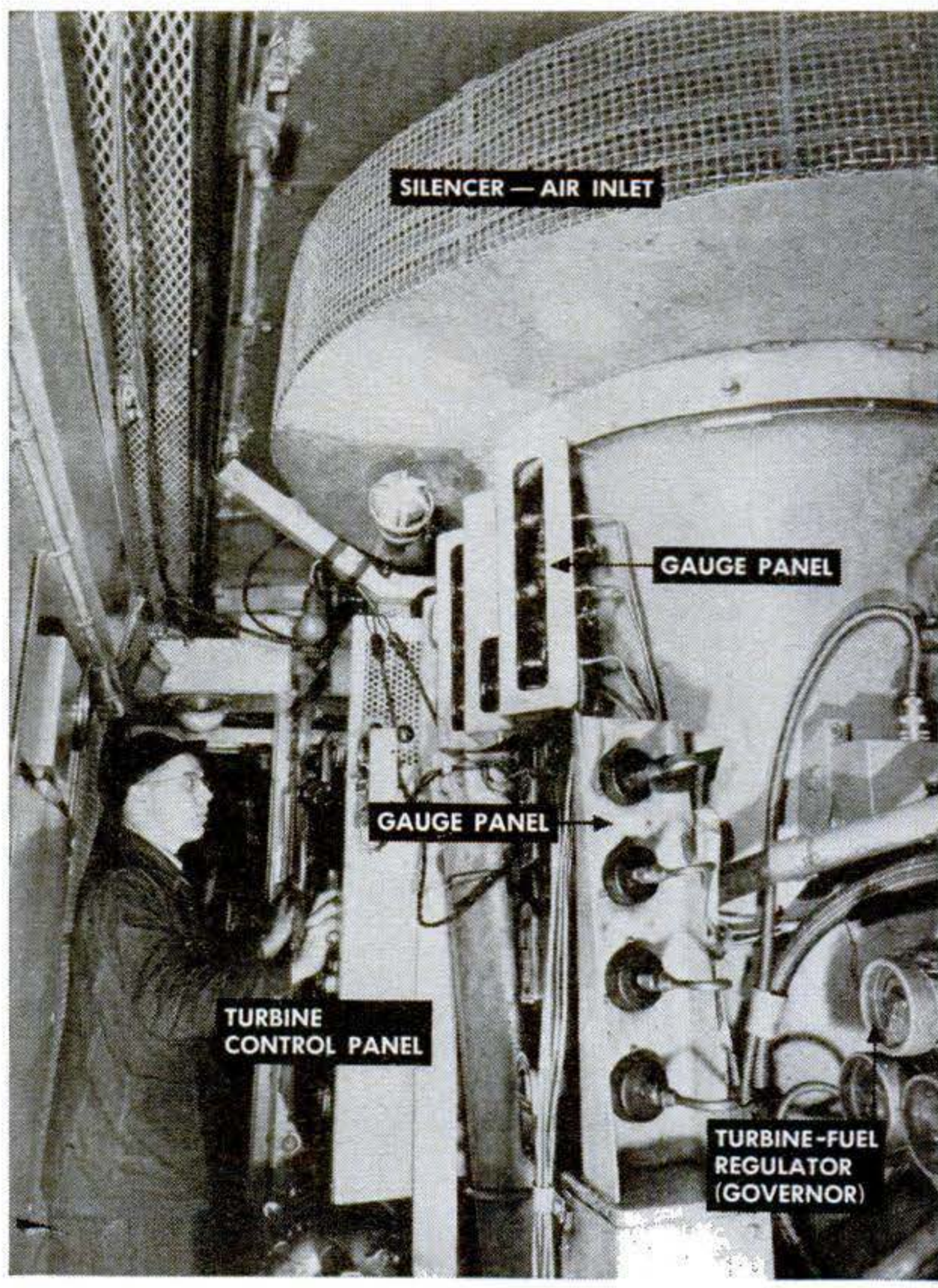
Inside cab, twin seats on left side go to head brakeman and fireman. Switches at right control order, class, nose, and marker lights. Steam-pressure gauge is at far left. Next to it is warning light for low water pressure. Edge of door to cab's nose can be seen at extreme right.

Right-hand seat is for engineer. Switches at left control headlights, order light, heater, defroster, headlight dimmer, and panel lights. Handle below them is throttle; smaller one, reverse control. Handle at right is automatic brake; smaller one in center, independent brake.

They started with the power plant, where they simplified and modified their aircraft-turbine designs to adapt them not only to locomotives, but also to power stations and other fixed installations. The result is a 25,000-lb. gas turbine with compressor, combustion chambers, and turbine in line. Weight, space, and money are saved, and the useful life increased. The designers hope it will go 15,000 hours between overhauls—three times as long as a Diesel. But for their gains they sacrificed such elaborations as regenerators. Instead, the exhaust goes roaring right out through the roof, at 150 m.p.h. and 850° F. (Test runs have shown no damage to tunnel roofs or bridges.)

The turbine shaft is geared down to drive four generators—the same type used in Diesel-electric locomotives. These power driving motors attached to each of the eight axles. The starting problem was solved by a small Diesel engine, which drives a small generator. That, in turn, powers one of the regular generators, making it a motor. This runs the compressor until firing speed is reached. Then the turbine is started with a spray of Diesel fuel before being switched to the regular fuel, Bunker C.

This same Diesel serves as the hostlering engine. The turbine's fuel consumption when idling is high, about one third that under full load, so it is not economical to use it for yard movements.



View down engine compartment shows narrow alley at side. In front of man is gas turbine's control panel. Behind him are air filters. The turbine uses 80,000 cu. ft. of air a minute.

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To make the sticky Bunker C flow up to the combustion chamber it must be heated. A steam generator has been built in and steam coils run down through the fuel tanks, which form the base of the whole locomotive. The oil is raised to 100° F. in the tank, then pumped up and heated to 200° just before entering the ignition chamber.

The side walls of the locomotive hold the dry filter to clean the 80,000 cu. ft. of air that the engine consumes every minute. When the locomotive runs through a snow storm, the flakes are sucked right through the wall and fly straight across the narrow inside passages. The cooler the air sucked in, however, the better the engine runs.

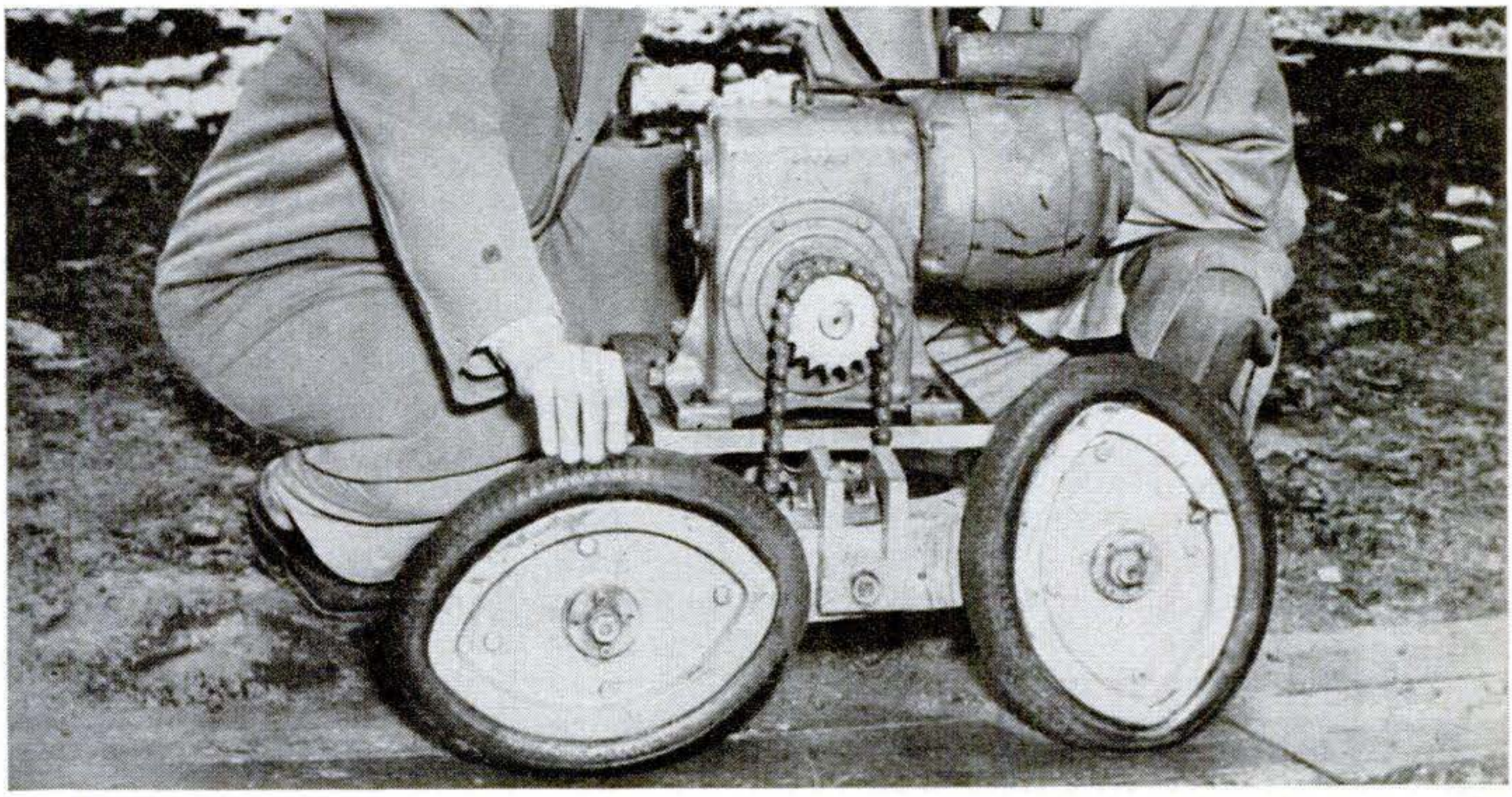
Scoring their new locomotive on a competitive basis against older types, GE engineers can point with pride to a power-length ratio of 53 hp. per foot of length. This compares favorably with about 30 hp. for Diesel-electrics and 50 hp. for steam, and is not too far from the 60 hp. per foot achieved by the highly efficient electric locomotives. The turbine burns a cheaper fuel too than Diesel oil, which partly makes up for the fact that its thermal efficiency—power output per B.T.U. consumed—is only 17 percent, about half that of the Diesels.

This matter of fuel consumption is one of the tough problems to be ironed out before the gas turbine can enter into full competition with her older rivals. Study is continuing on the use of powdered coal instead of oil. If this proves successful, future gas turbines may burn coal and the present oil-burning type may prove only an intermediate stage (PS, Nov. '48, p. 98).

The 55,000-lb. difference in weight between running with full tanks and almost-empty ones is another point the engineers will watch closely. The weight is taken from the drivers, so there is a traction loss equal to losing one driver.

On her test runs at Erie, Pa., the gas-turbine locomotive would roar along parallel to the main line of the New York Central. There she would meet a giant steam locomotive rocketing along at 70 m.p.h., under a great pillar of smoke and spume of snowy steam. The two—the oldest and the newest breed of locomotive—would ignore each other like jealous rivals. Someday, perhaps, the gas turbine's roar may rule the rails. END

Egg-Shaped "Walking Wheels" Conquer Mud



WHEN the going gets tough in mud, snow, or sand, the oval wheels shown above "walk" right through. Two of the new wheels replace ordinary rear-drive round wheels on each side of the vehicle. They are geared so that one of each set is on end while the other is flat. The wheels are connected by a rocker arm, at the center of which the rear axle is pivoted. Thus, as the wheels turn, the connecting arm moves up and down like a seesaw. The pivoting axle point, however, always remains at the same distance from the ground, giving a smooth ride.

Main advantage of the "walk wheels" is greater traction. The inventor is John F. Kopczynski, of North Tonawanda, N. Y.

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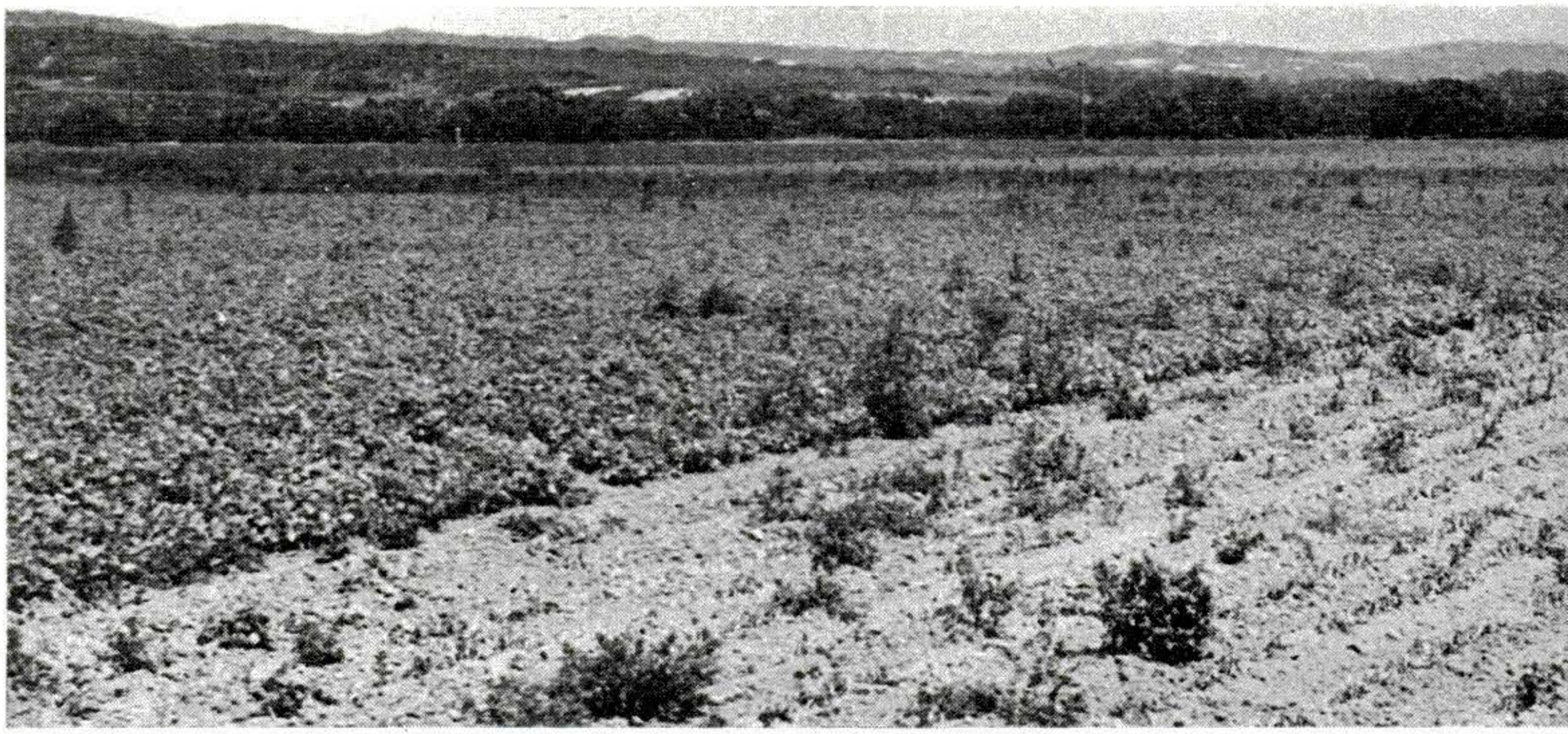

Photo of field uniformly planted with beans demonstrates effectiveness of fumigating soil.

Fire and Brimstone Cure Diseased Soil

Dirt farmers praise George Woods' heat treatment of pest-ridden soil in face of experts' skepticism.

By Ladd Haystead

YOU, the American consumer, are paying millions of dollars a year to support enemies you never see. They are the bugs, the fungi, and the weeds that infest ever-increasing areas of our agricultural lands. What they subtract from crop yields, you pay in higher prices at the store. What the total cost is no one knows accurately, but the guesses run as high as several *billions* annually. Now comes a man with a machine that he says can change all that—make the farmer more prosperous and the consumer happier, for nobody profits from lost production.

He proposes to cure pest-ridden soil with a fire-and-fume-spitting mechanical monster.

The story goes back a quarter of a century to Southern California. George Woods was a poverty-stricken farmer who faced complete failure. His troubles didn't stem from his lack of skill or industry. They were, instead, entirely the doing of microscopic enemies in the soil. The enemy that was about to deal the final and catastrophic blow was black scab, a potato disease that had made Woods' whole crop worthless. The previous year rust had ruined his wheat, and wilt had taken his tomatoes two years before. Woods was licked. And many of his neighbors faced the same prospect.

But his wife had an idea. Fumigation got rid of household pests. Why wouldn't it work on soil? He answered as many another hopeless farmer has done. Armies of skilled technicians in the experiment stations, at the Department of Agriculture, and in private business had not been able to cope with the pests. What could a lone farmer with no intensive laboratory training do?

That didn't satisfy Mrs. Woods. He could try, at least, couldn't he? And as many another American farmer has done before and since, Woods started to tinker up a machine that neither the experts nor the industrialists had thought of.

He took the hopper off an old feed grinder. He forged an iron, plowlike shoe and built a gas burner into it. An old hay rake gave him a frame and wheels. From other junk he rescued a gas tank, an engine,

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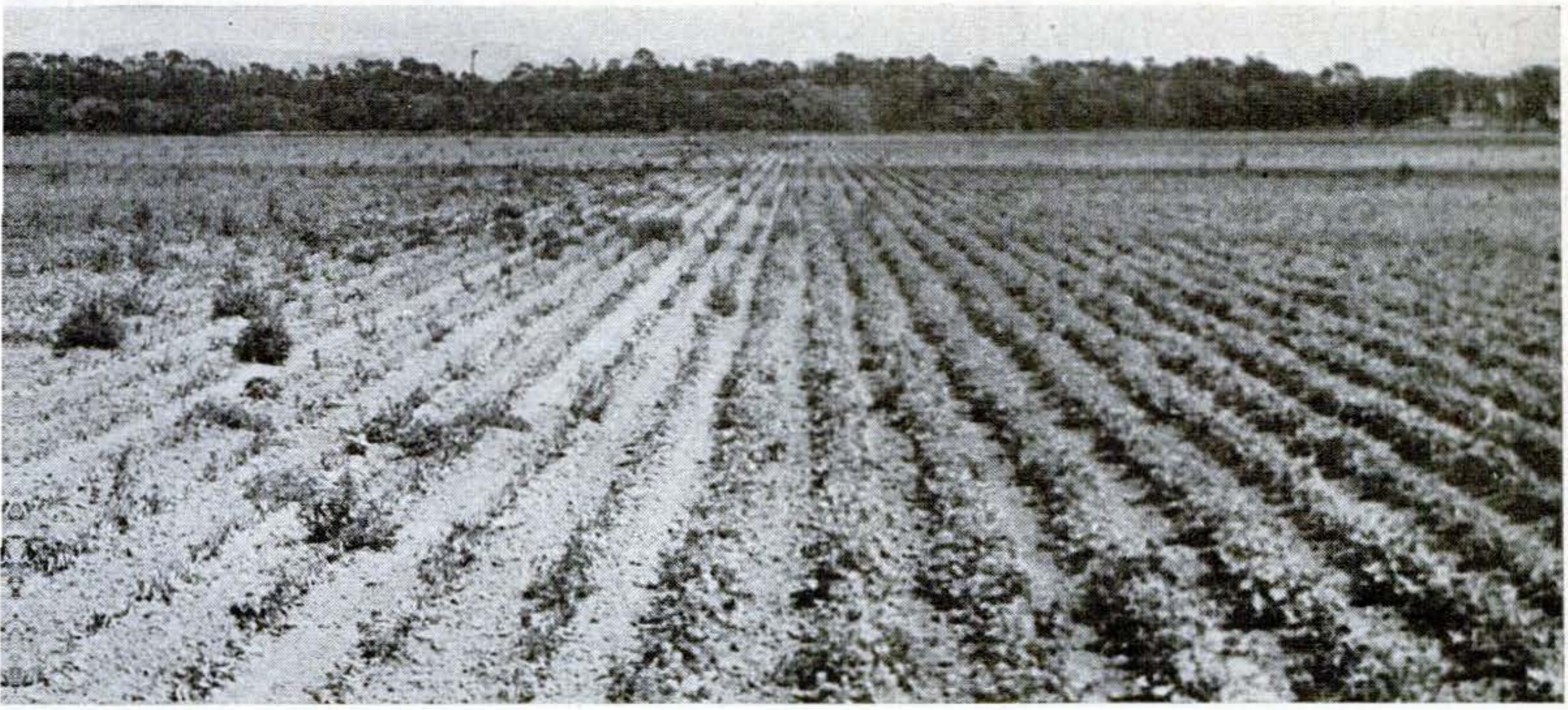

The center strip, almost bare, was left untreated; fertile areas on each side were renovated.

HOPPER HOLDS CHEMICALS AND MINERALS

SULFURIC ACID TANK

BUTANE OR PROPANE FUEL

BLOWER

TUBES CARRY SULFURIC ACID TO BURNERS IN SHOES

HYDRAULIC PUMP POWERED BY TRACTOR

AIR PRESSURE FORCES CHEMICALS THROUGH TUBES TO SHOES

BOARD SMOOTHS SOIL TO SEAL IN FUMES

SHOES CONTAINING BURNERS

This is the weird-looking machine that plows flame and chemical fumes into the soil to kill weeds and disease. The photo above shows the first model to have four digging shoes.

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and a blower. From the hopper he rigged a rain spout and hose to the metal shoe, and connected the gas tank to the shoe with copper tubing. Then he rounded up all the poisonous materials he could find and tossed them into the hopper with a couple of bags of sulfur. He lighted the gas burner, turned on the blower—and almost asphyxiated himself.

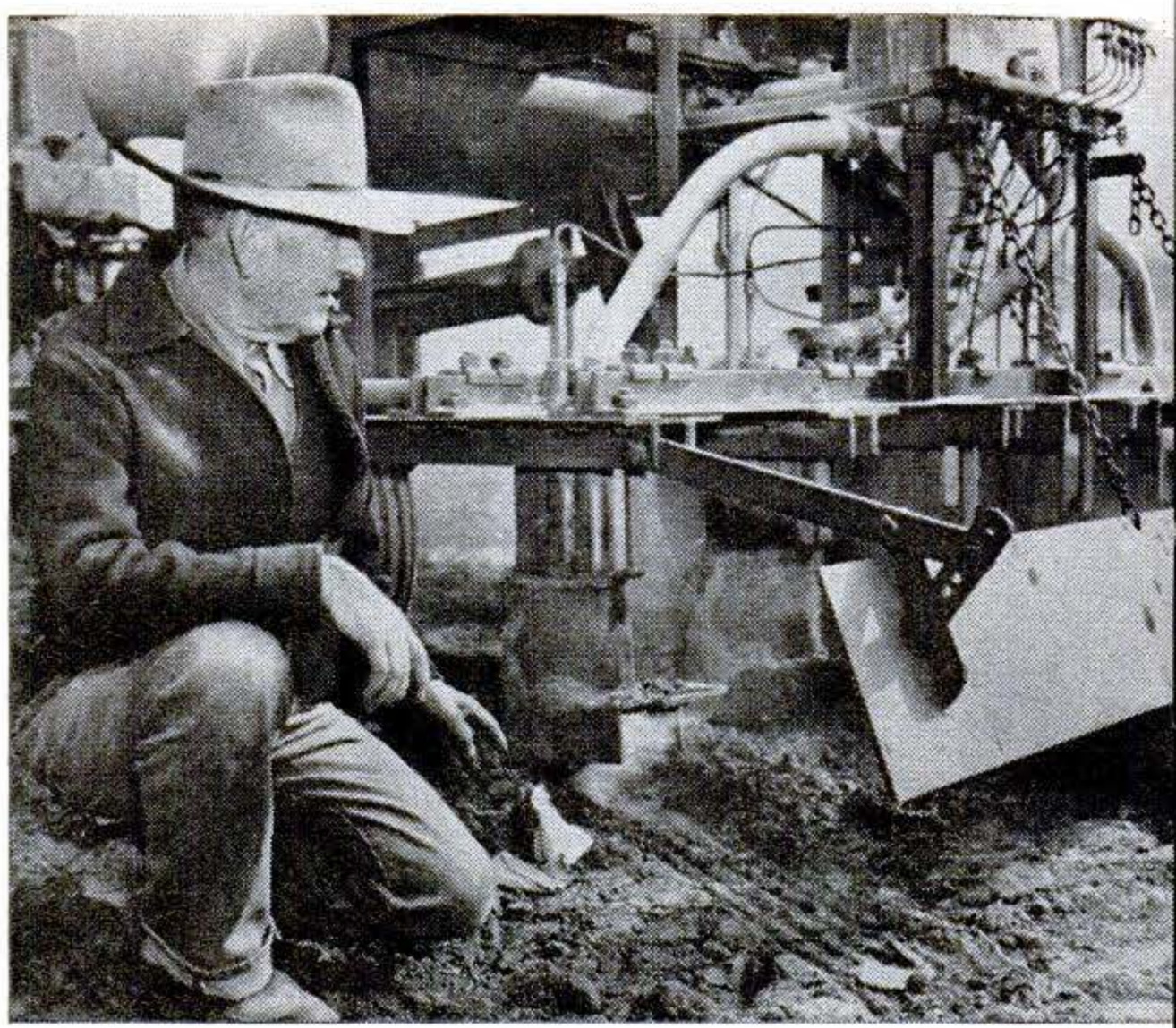
Out on the infested fields, he dragged his Rube Goldberg contraption behind a small tractor. Up and down and crosswise he went, with the metal shoe digging down into the earth, spouting its lethal, flaming dose at the diseased soil particles. He didn't know what was happening, if anything, or what the chemistry of the treatment was. There was even a chance that he was turning poor soil into stuff that would never grow anything again. But he was licked anyway.

Two days later, he planted potatoes—scabby potatoes, because there was no money for disease-free, fresh seed. Then the miracle he had to have to start again happened. In less than three months he harvested from the one-time unhealthy soil and diseased seed a clean, wholesome, and profitable crop!

Tedious Development Followed

Since then, he has turned out model after model of his soil fumigator. Slowly, this defect and that have been eliminated. At the same time, trial and error have shown what his machine can and cannot do, what conditions are necessary for optimum results. The scope of the machine's usefulness has been enlarged enormously. For instance, it will also neutralize alkaline ground, lowering the alkali content enough to make cropping again possible. This is vastly useful in irrigated areas, where large acreages are lost every year to the ever-threatening alkali. The machine destroys many weed seeds, but not all. Morning glory, a major pest, is so deep-rooted and vigorous that it will make a comeback even after the flame and killing gas have attacked it. But today literally hundreds of growers all over the West Coast and in the Southwest are pleading for final, perfected machines. Commercial production has just begun at Rundle's Manufacturing Co., of San Jose, Calif.

Getting this far has not been easy. There were failures, disappointments, and lawsuits. Even now, as this writer checked with experts, the word was that the machine was incredible—a crackpot's dream—wouldn't work,



Inventor George Woods explains operation of the fire-and-gas-spouting shoes of his machine.

would probably kill all the wanted microorganisms (like *clostridia* and *azotobacter*, which "fix" nitrogen from the air into a form usable by plants). Yet, when you see several hundred realistic farmers come from hundreds of miles away to watch a demonstration and then get out their checkbooks, a reporter can be forgiven for not waiting on approval from all professional researchers.

Not all experts are so skeptical of soil fumigation, however. The Woods company has several professional agricultural scientists on its staff. And the Dow Chemical Co. —not connected with Woods—makes a fumigant for the control of wireworms and nematodes, Garden Dowfume®, that can sprinkled on your home garden from a quart fruit jar.

With only a few machines available up to now, Woods has been doing custom work, but doing it in his own way. The inventor won't take an order for fumigating a whole field. He will only do a small test plot, leaving an untreated strip down the middle. After the farmer has planted the treated area, reaped his crop, and still wants larger acreages handled, then Woods will take the job. Even this unconventional selling doesn't deter the would-be customers. But Woods insists and won't be budged even though the owners are ready to plank the money down on just the say-so of neighbors. When you are facing the loss of a high-cost crop and someone tells you he personally was saved by a curious contraption, you don't quibble over scientific disinterest.

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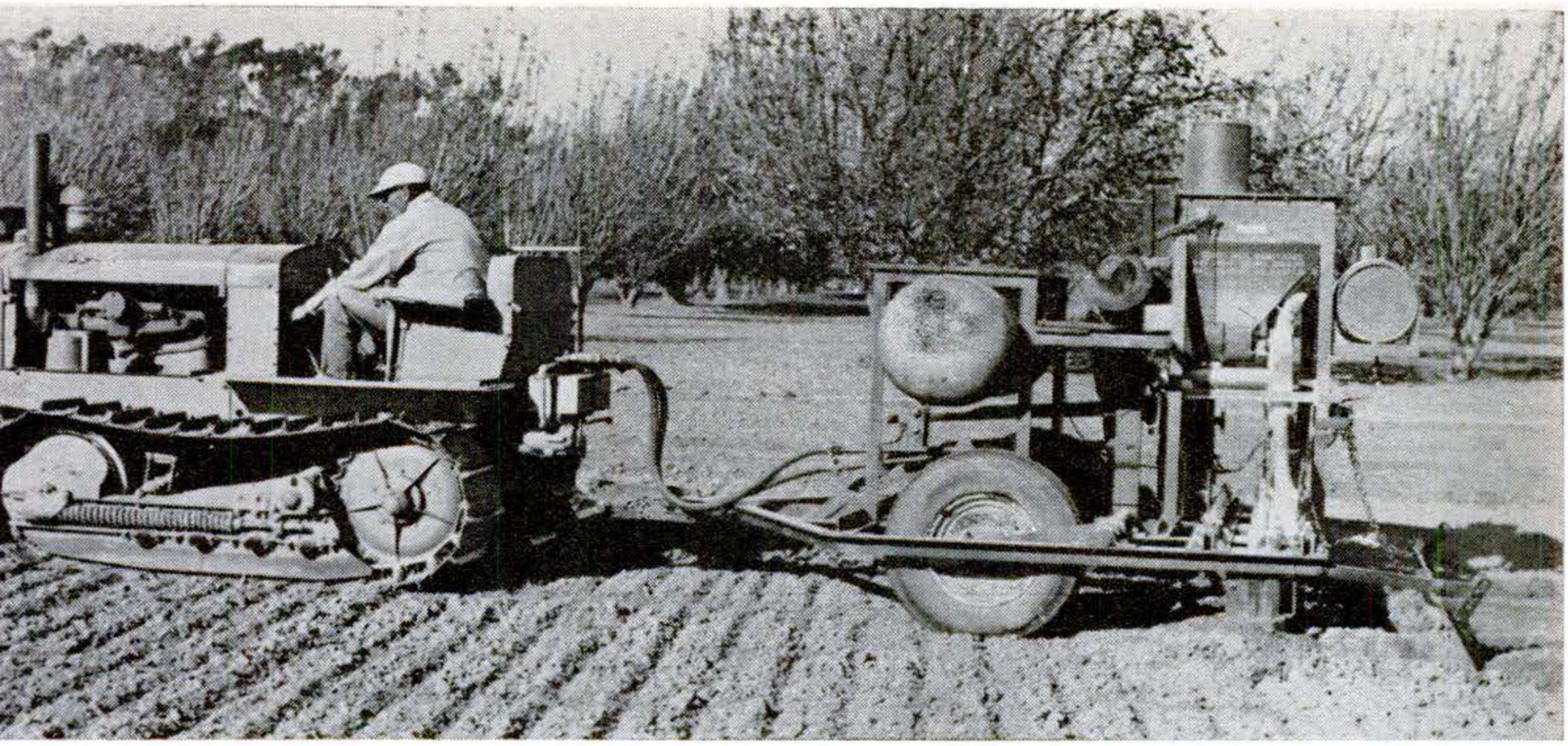

In use, the soil renovator is pulled by a tractor. The machine has been doing custom work until now, fumigating large acreages only after tests of small plots gave successful results.

One such desperate man was Alexander Lake, lily grower of Smith River, Calif. He had a large investment in his business. Customers were clamoring for his blooms. But rust, nematodes, and fusarium rot were sending him straight toward bankruptcy. He traveled widely, interviewed plant pathologists, parasitologists, and experts of every kind who might conceivably have any answers. He tried everything suggested, but still the parasites got ahead of him. He heard about the Woods machine and even though he thought it probably was on a par with rainmaking or voodoo rituals he cajoled the reluctant inventor to fumigate for him. Lilies were something Woods didn't know much about. Result? That year Lake won the national lily championship. Today, as well as growing lilies he is an executive of the company manufacturing and exploiting the machine. Also, he keeps on hand, ready to show any unbeliever, sworn affidavits from satisfied customers all over the Southwest.

For the present, the machines are at work on the paid demonstrations. The cost runs about $20 an acre, which includes the use of the machine and the operator's wage. Materials used average around $7 more. The machine costs about $3,500, but the price is expected to come down when quantity production is attained. Then an owner will be able to operate for around $10 per acre. The treatment's good effects last for several years on most soils, but the Woods-Lake combination thinks a light and inexpensive treatment every crop year is a better deal and real economy in the long run.

Some of the combinations of materials are secret, but others are not. For instance, for nematodes, minor fungi, and fusarium rot they use this weird mixture: pulverized sulfur, powdered blue-stone, sulfuric acid, and, if the soil is alkaline, gypsum too. This frightening combination is also effective against wireworms, cutworms, root aphids, etc. In this case the farmer is told what to get, and he can shop for it any place he thinks will be most reasonable. For the secret formulas, however, he has to buy the already-prepared materials from the fumigators.

To prevent wrong usage, soil samples must be lifted first and sent to the fumigators. Their bacteriologist analyzes the samples for bacteria, fungi, pests of all kinds, nutrients, and acidity. He then works out a tailored formula for that particular soil. These materials are poured into the hopper, converted to a hot gas, and blasted into the soil for eighteen inches in all directions. Three days later planting can begin.

Here are the claims that those afore-mentioned affidavits seem to bear out. Not only will the soil be sterilized of unwanted parasites, but also iron, ammonia, phosphorus, chlorine, calcium, nitrates, and potassium will be added in sufficient quantities to assure plant growth. The three major fertilizer materials—nitrogen, phosphorus, and potash—are air-blasted into the soil in a

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separate operation. And, while there is no proof other than the whopping yields the treated ground provides, there seems to be no destruction of the wanted soil bacteria.

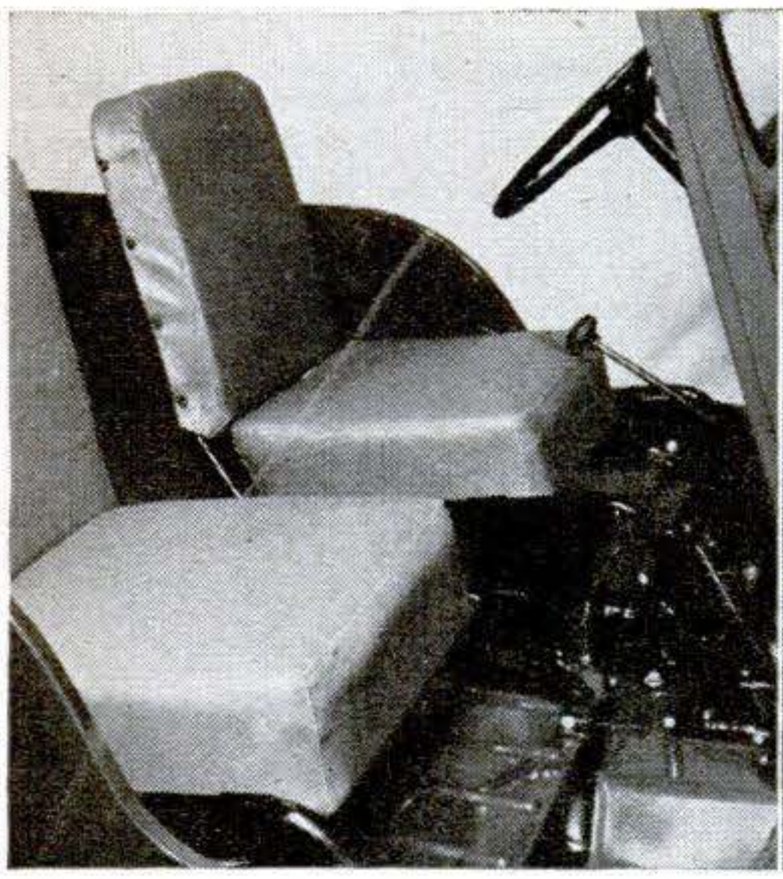
Some of the testimonials run as follows: Ed Timken, the roller-bearing man, was in high trouble with Arizona thistles in his flax fields. Thistle seed cannot be screened out. Selling flaxseed and hay infested with the weed is unlawful. After everything else failed, Woods treated the field. The next crop was highly profitable and free from thistles.

George Tunada, of Dutch Flats, near San Diego, Calif., was in a bad way with wireworms, nematodes, beetles, corn borer, and other root and foliage pests. He says: "After treatment by the Woods machine I grew excellent crops of sugar corn and carrots on land that had been too infested to grow anything. Another plot was so infested that I had to discontinue growing tomatoes. After treatment by Woods' machine, I grew a profitable crop with no evidence of pests. Still another plot of cabbage was a total loss because of pests on roots and heads. Woods treated this field for me, too, and I grew a fine crop of red cabbage, every head was large and solid."

There it is—the experts say it can't be so. The farmers who are begging for machines and custom work aren't paying any attention to the experts.

The 72-year-old inventor has no desire to make a fortune. He does have a fierce, almost zealot's urge to help his brother farmers. One company made him a handsome offer for his patents. When it wouldn't write into the sales contract an agreement to manufacture a minimum number of machines a year, he got suspicious that it meant to "bury" his invention. Despite an even better offer, he turned the company down and stalked off. Now he feels his machine will one day not only be at work on fields all over America, but elsewhere in the world, as soon as experimentation can be made in each climate and soil type. He will not permit it to be used in a new area until it has been tested on sample plots. And he is quite candid as to its limitations.

"Well, right's right and wrongs nobody," he says. "The machine won't cure virus diseases. It will kill morning glory only when the ground is very dry. It won't work well unless clods are broken up. But, I'll tell you something—I ain't had a cold since I sniffed those fumes 25 years ago." END



Jeep Gets New Civilian Comforts

GIs won't recognize a ride in a jeep anymore—most of the bounce is gone. In the latest models, the bone-jarring, old-style seats have been replaced with seats of the station-wagon type (left, above) having newly developed zig-zag springs and thick cushions.

Willys-Overland engineers have incorporated some other changes, too. They have provided an air vent under the windshield, and have mounted the windshield itself in rectangular metal tubing (right). Channels in this tubing hold the side curtains. The curtain is simply slid into the channel, eliminating buttons or any other fastening.

Mechanical improvements include greater ground clearance below the steering linkage, to improve driving ease off the road, and a foot-operated, starting-motor control that aids cold-weather starting.

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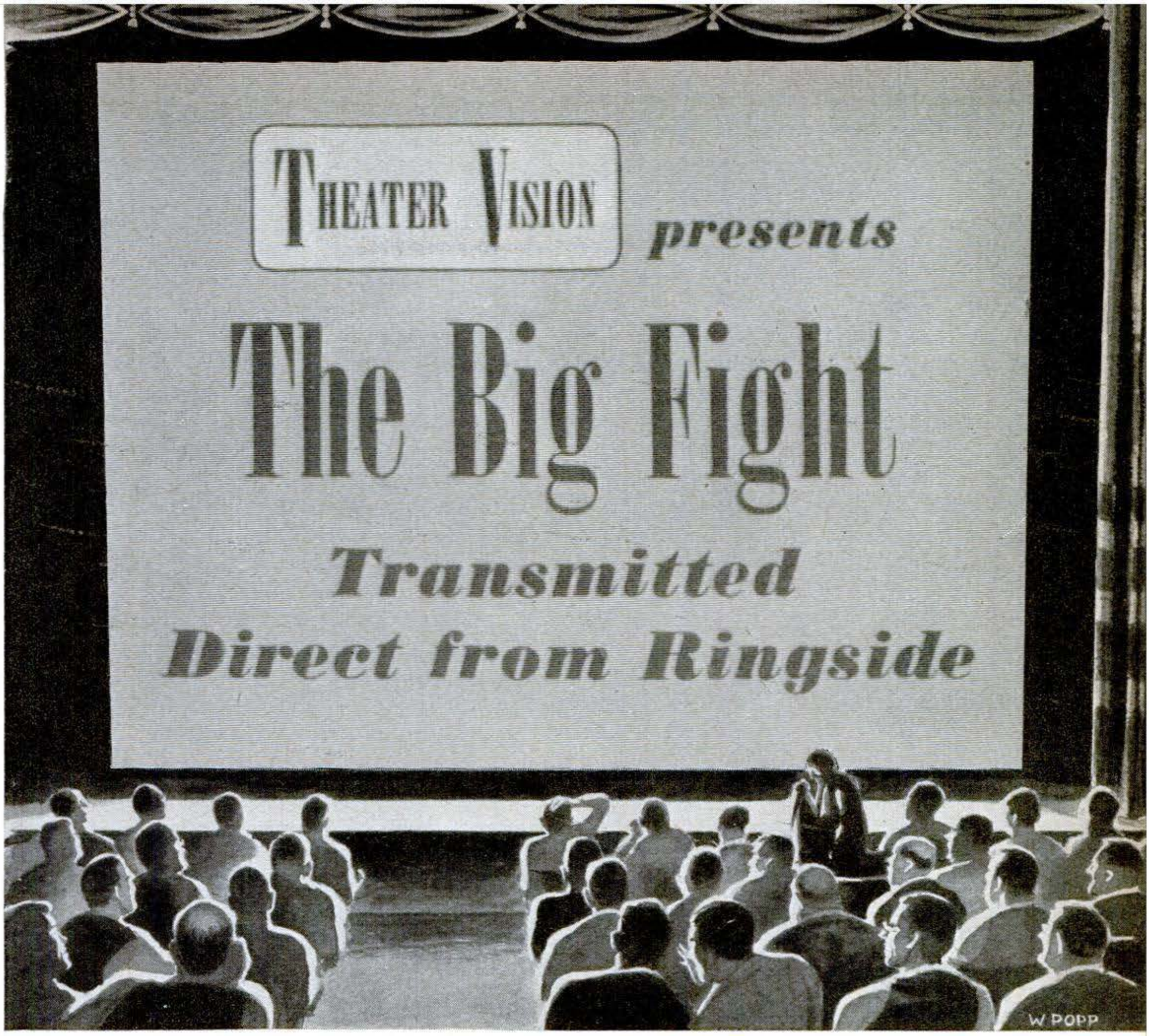

You'll soon see top television shows on the huge screens of movie theaters —new types of equipment will do it.

By George H. Waltz, Jr.

Drawings by Lester Fagans and Walter Popp

TELEVISION is coming to your neighborhood theater. Soon, say experts, movie houses will be dishing up special television entertainment instead of second-rate second features. You then will be able to relax in a comfortable seat and enjoy championship boxing bouts, World Series baseball, bowl football games, and important news events as well as if you were right on the spot. And many of these special TV theater shows will not be flashing on the screens of home receivers.

Most important of the factors bringing television to the movie houses is new equipment able to project bright, movielike television images on a full-size theater screen. But basic dollars-and-cents business is involved, too. Theater owners have their eyes on audience-pulling television features, while sports promoters see the possibility of $10,000,000 box-office gates in television rights leased to theaters. A championship prize fight, they point out, could be staged in a small studio instead of a big arena and be viewed by millions of fight fans—at 85 cents or $1.10 each—all over the country.

The same reasoning applies to the big commercially sponsored TV shows—the sponsors want bigger audiences; the movie men want those audience-pulling shows in their theaters.

When television pictures do reach your local theater—successful demonstrations already have been made in several major cities—they will get there via one of five different types of video projectors now being groomed for the job. The basic systems are shown on the following pages.

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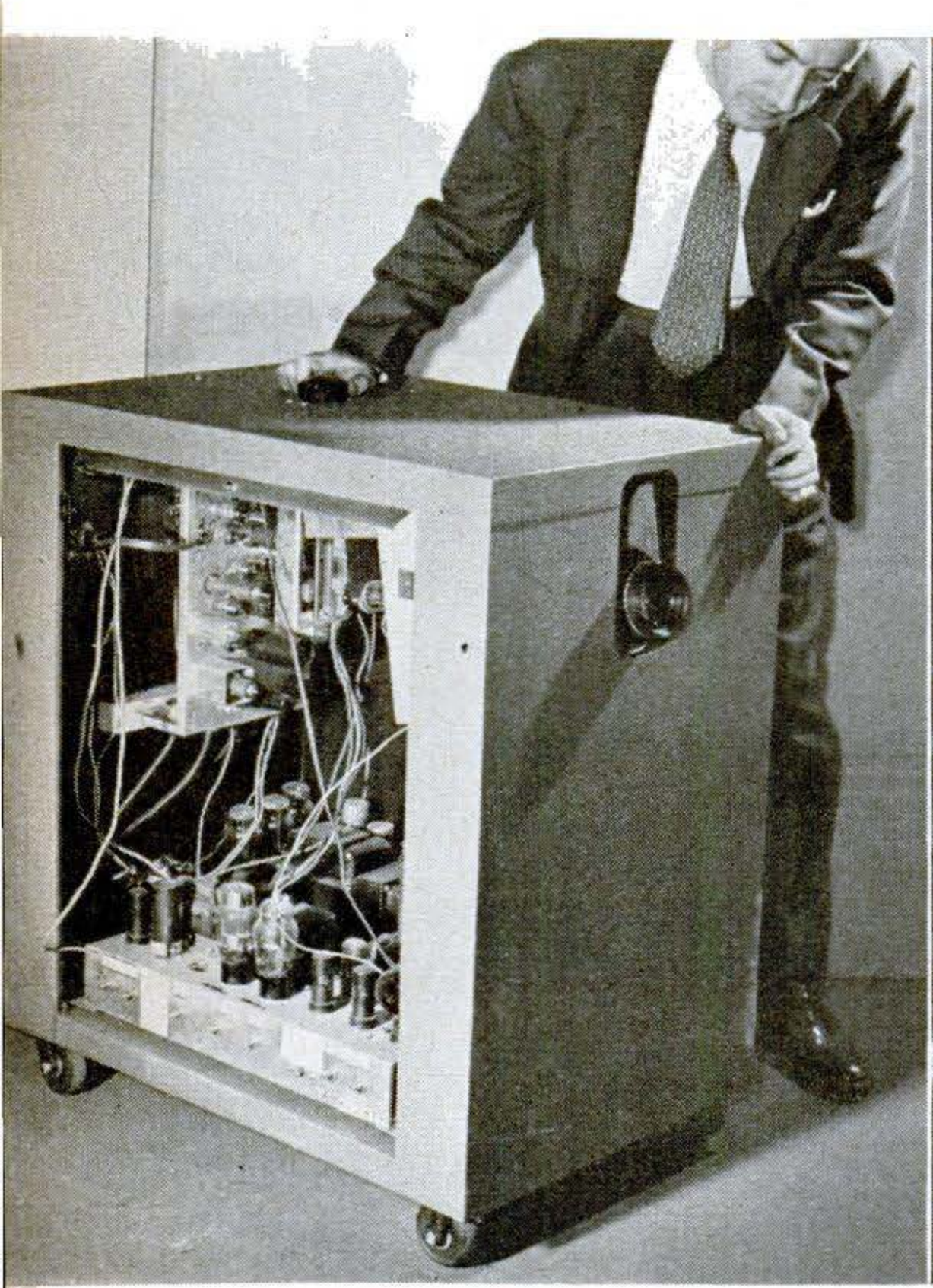
REFRACTIVE & REFLECTIVE PROJECTION

THE refractive and reflective methods of TV theater projection resemble the basic methods used in the familiar projection-type home receivers—they project the images formed on a cathode-ray tube directly onto a remote screen.

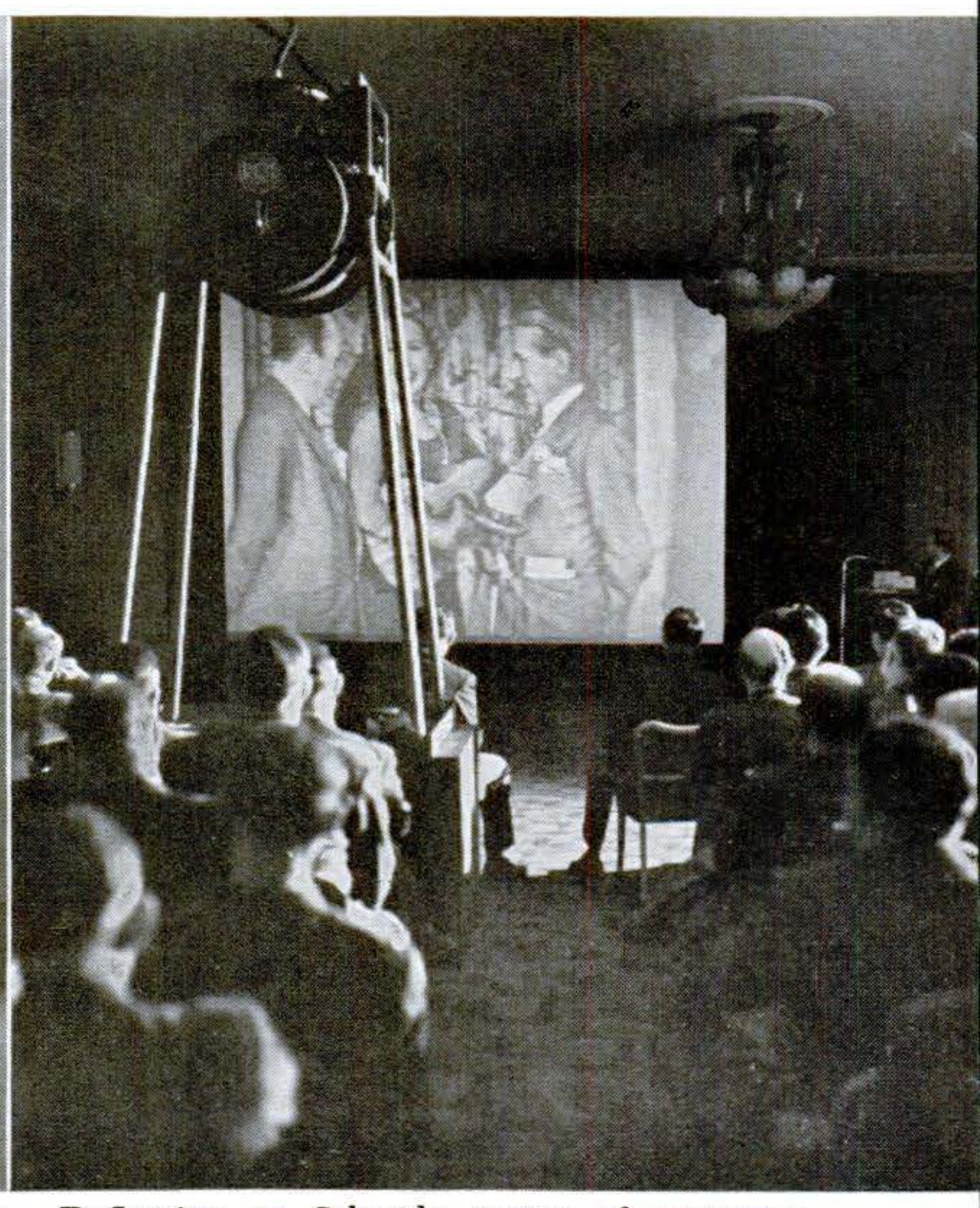
In the refractive system, a projection lens, placed directly in front of a high-voltage picture tube capable of producing brilliant images, throws the images on the screen. It is very similar to motion-picture or lantern-slide projection, with the cathode-ray tube simply replacing the film in the projector.

The reflective system, on the other hand, makes use of a spherical mirror and a ring-like corrective lens to magnify and project the tube's image. Originally developed as an astronomical telescope—and now widely used in that science—it is usually called the Schmidt system after its astronomer-inventor. Basically, the design of a reflective projector resembles that of an old-fashioned "magic lantern," with the brilliantly glowing picture tube taking the place of the illuminated post card, and with a spherical magnifying mirror replacing the flat reflecting surface. The ringlike lens corrects for the spherical distortion introduced by the mirror. The picture tube faces away from the screen in the Schmidt system, its image being picked up by the spherical mirror and projected forward to the screen through the correcting lens that circles the tube's neck.

In both the refractive (lenses) and reflective (mirror and lens) systems of projection the brightness of the final picture on the screen depends entirely on the brilliance of the image formed on the cathode-ray tube. For this reason, extremely high voltages must be used to produce a cathode-ray beam powerful enough to get the maximum light output from the tube's fluorescent screen. Voltages as high as 80,000 often are necessary. However, the tubes can be small in size, frequently having pictures hardly larger than a postage stamp.



Most direct way to project television on a big screen is with a lens in front of the cathode-ray tube. A typical refractive projector is the U. S. Television model that is shown above.



Reflective, or Schmidt, system of projecting television uses mirror and lens to get big image. Latest RCA model (above) can fill a 15- by 20-ft. screen, may be available late this year.

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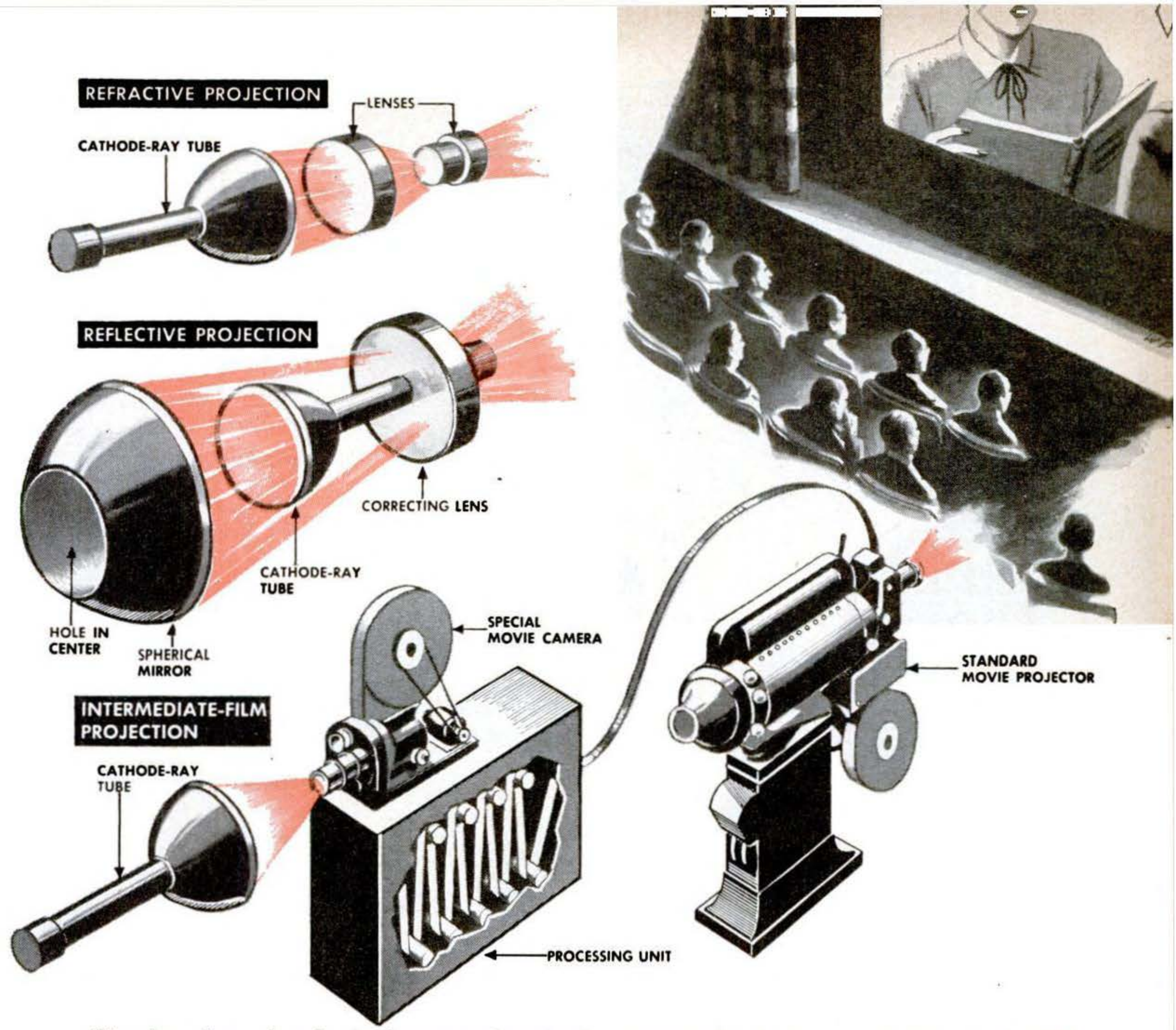

Sketches above show basic elements of projection systems that have seen actual use in the U.S.

INTERMEDIATE-FILM PROJECTION

SINCE cathode-ray tubes can provide only a limited amount of light for projection, some engineers favor a theater-television system in which the final brilliance obtained on the screen comes not from a picture tube, but from some outside source—an incandescent lamp or a carbon arc.

One such system is the intermediate-film method of projection, which has been successfully demonstrated at New York's Paramount Theater. This is a continuous, three-step process making use of a direct-view television receiver, a special sound-on-film motion-picture camera, a high-speed film processing unit, and a regulation movie-theater projector. The TV images, displayed in this case on the tube's screen as negative images, are photographed continuously on positive film by the camera, which has been altered to compensate for the difference between the 24 exposures per second used in making movies and the 30 images per second used in television.

As the film is exposed, it enters an automatic, high-speed, high-temperature film processor, where it is developed, fixed, and dried. From the processor it is fed directly to the motion-picture projector. Elapsed time from TV image on the receiver to projected image in the theater—56 seconds!

A number of companies, including the Radio Corporation of America, Eastman Kodak, and others, are experimenting with the intermediate-film process. Among the improvements being tested are magnetic sound recording and a more precise shutter and film-moving system that will give smoother motion.

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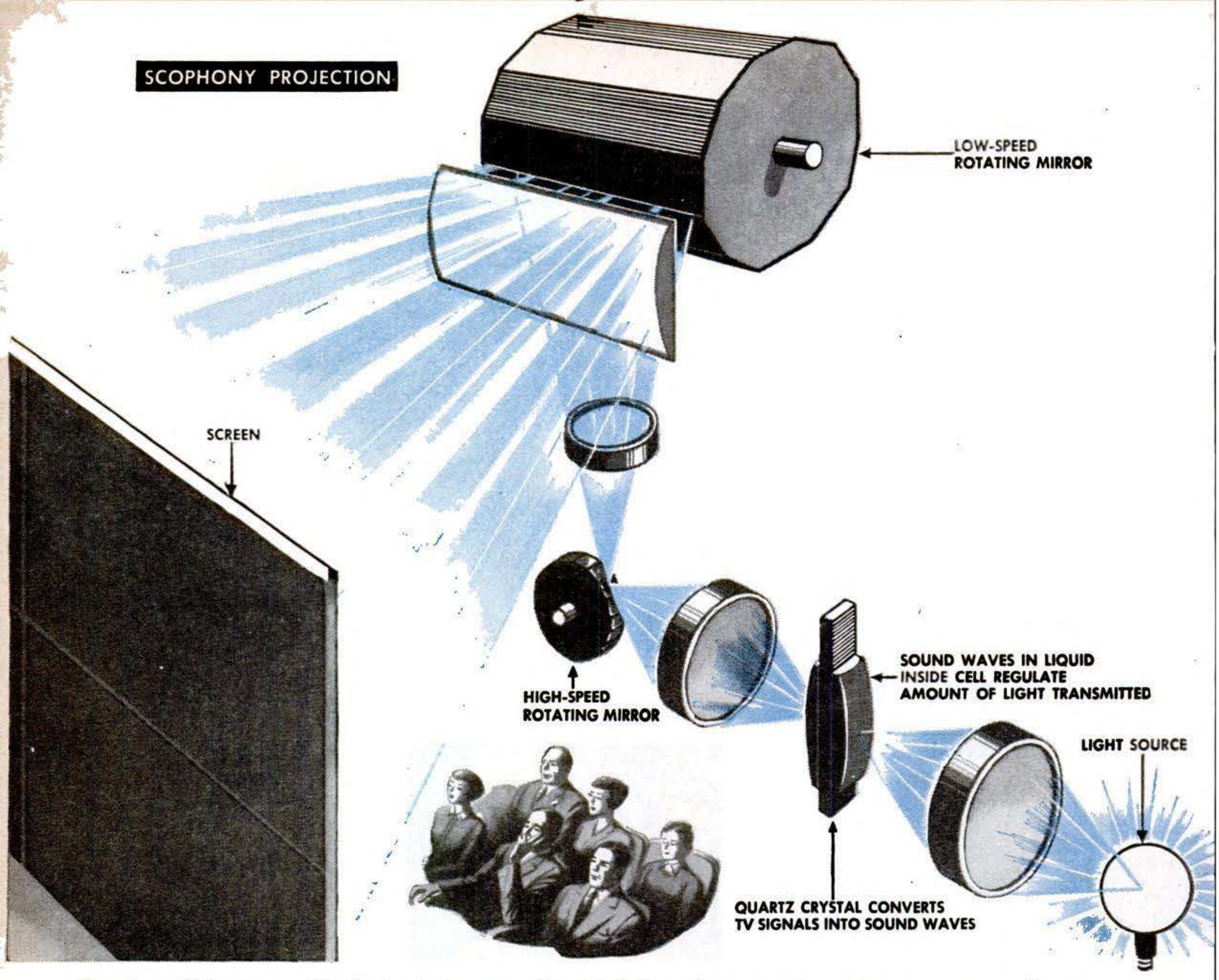

Scophony® has no cathode-ray tube, uses liquid light valve, rotating mirrors to create image.

SCOPHONY PROJECTION

MOST revolutionary of the TV projection systems is Scophony®. It has no cathode-ray tube at all, but uses a light valve, rotating mirrors, and an arc or incandescent lamp to turn the television signals into screen images.

Two things are needed to make a television image in any system: spots of light of the proper brightness, and a way to scan, or place those spots in the correct positions to form the picture. In ordinary electronic television, the spots are created by varying the strength of a cathode-ray beam in accordance with the incoming signal, and the spots are placed by moving the beam. In Scophony, the spots are made by varying the strength of a light beam with the valve—a sort of continuously changing filter—and placed by reflecting them from the mirrors.

The light valve is a liquid-filled cell containing a quartz crystal. The crystal is connected to the incoming television signals, converting them into high-frequency sound waves. The varying sound waves change the liquid's index of refraction—the amount it will bend a beam of light passing through it. Thus the signals control the amount a light beam will be bent passing through the cell, and therefore the amount of light that will pass *directly* through it. This makes the spots of light of the proper brightness.

To place these spots in their right positions, Scophony has two motor-driven, many-sided, mirrored drums—one to scan from side to side, the other up and down. A small, high-speed scanning drum picks up the light spots from the valve and reflects them, one by one, to form a single horizontal line on one of the mirrored faces of a low-speed scanning drum. The low-speed drum, with the aid of a lens, projects each line, one below the other, onto the screen to form the completed image.

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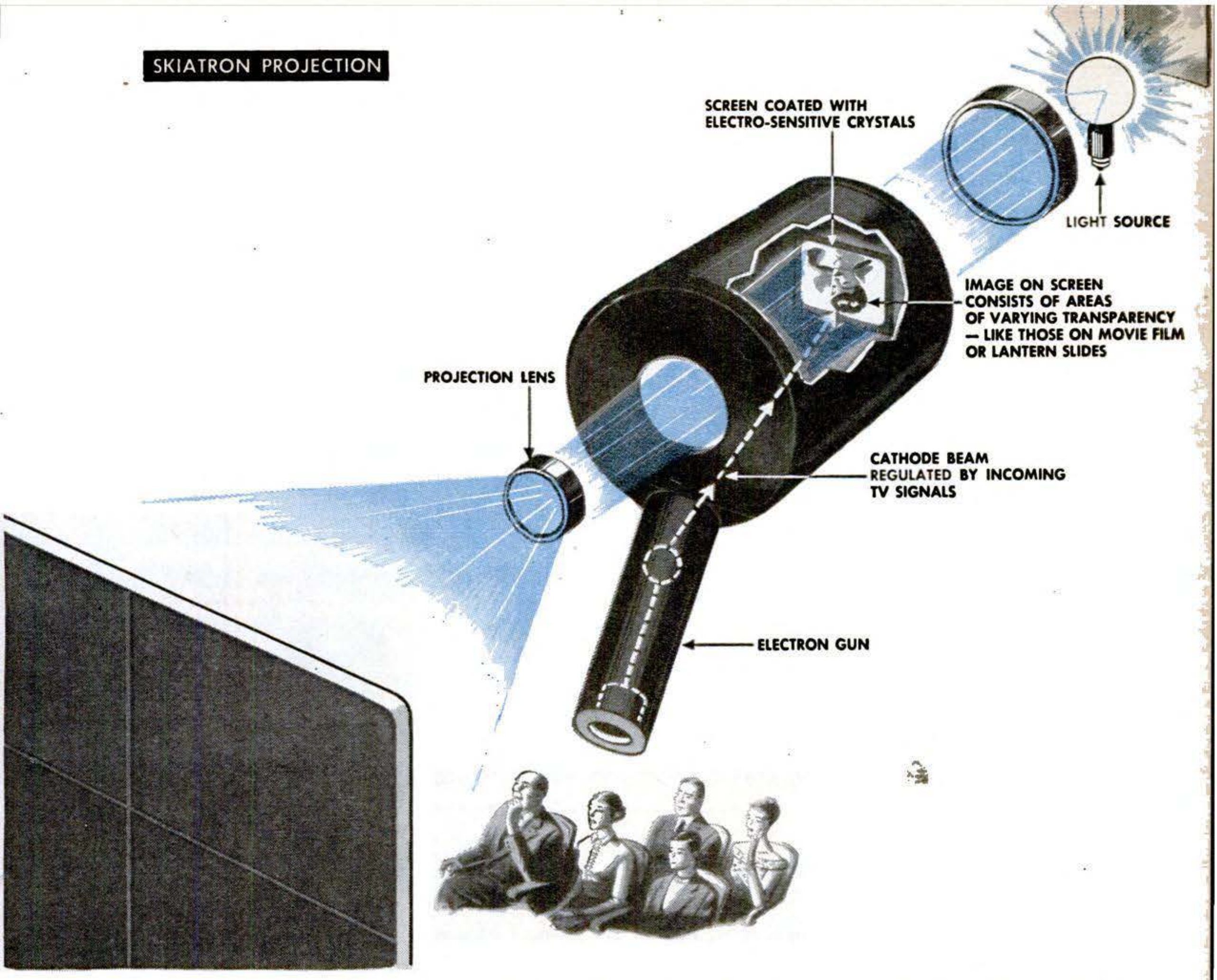

Skiatron system, used in wartime radar, employs special cathode-ray tube to make pictures.

SKIATRON PROJECTION

STILL in the laboratory stage of development, the skiatron system of TV projection promises one of the simplest methods of putting bright images on a big screen. It uses an independent light source, but with an all-electronic image-forming device, thus eliminating the difficulties usually involved in mechanical scanning.

The heart of the system is a new kind of cathode-ray tube—the skiatron tube—that has a screen of electro-sensitive crystals (such as potassium chloride) rather than the fluorescent screen found on ordinary cathode-ray tubes. These electro-sensitive crystals act just the opposite way fluorescent screens do. Instead of glowing when struck by a beam of electrons, they darken—and darken in direct relation to the strength of the electron beam hitting them.

Placed in a television-receiver circuit, the skiatron tube produces "shadowgraphs," or lantern-slide-like transparencies, rather than brilliantly glowing pictures. By arranging the tube's components at a 45° angle, rather than in a straight line as in the normal cathode-ray tube, the concentrated beam from a powerful light source can be used to project the tube's filmlike images onto a large screen. The skiatron projection system, in effect, makes it possible to employ the normal movie-projection technique used in the intermediate-film method—without the intermediate film! By using three-tube arrangements with filters, skiatron could also project color television.

The skiatron tube, still under development for television, saw war use in projecting radar images aboard battleships. One difficulty, which was unimportant in radar but must be corrected for television, is the relatively long persistence of the shadow image it produces. END

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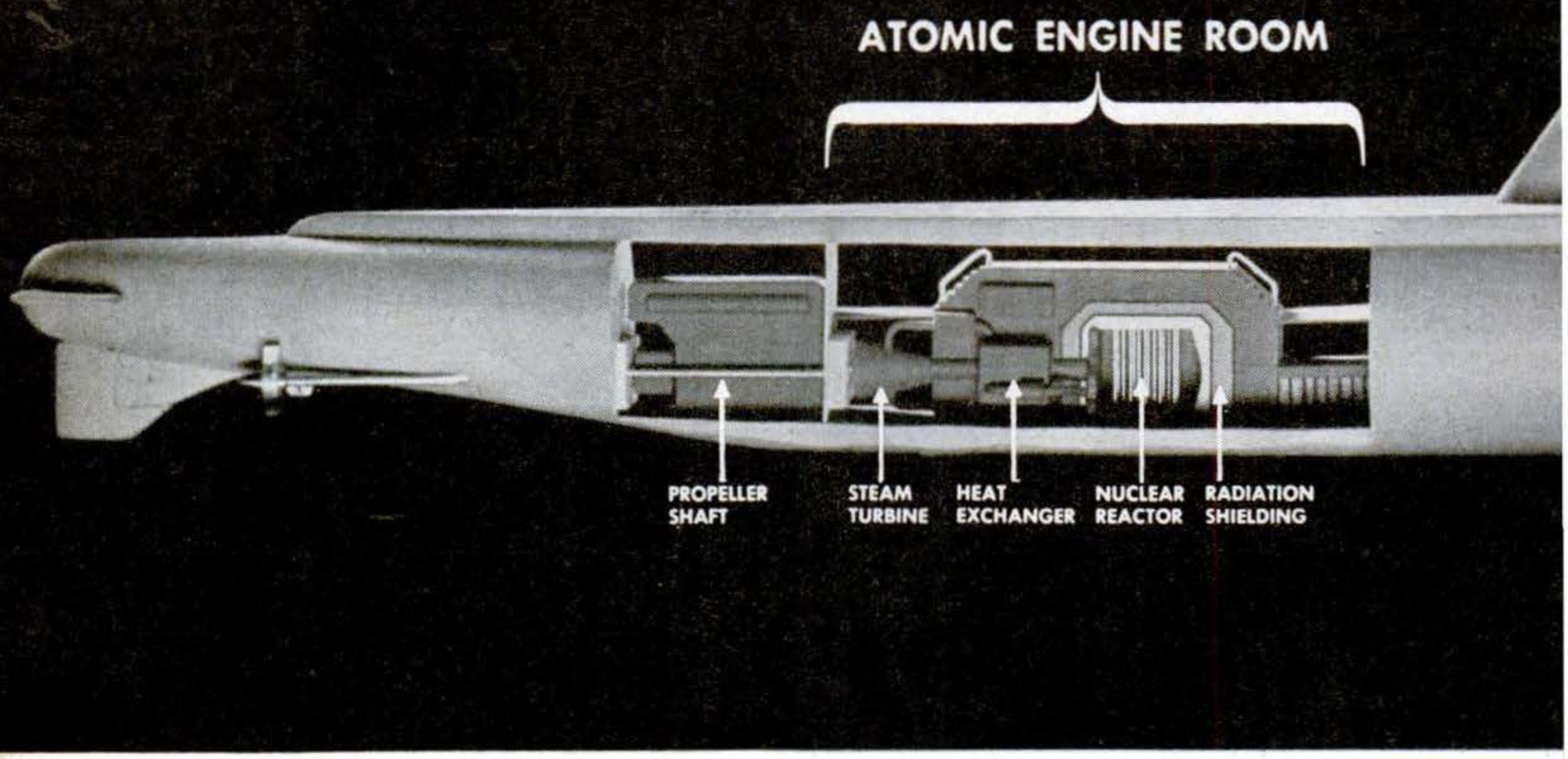

Atomic engine would increase the range of a submarine and enable it to be submerged longer.

Will Atomic Engines Be Mobile?

Navy will get experimental model. Delayed neutrons will make it safe and easy to run.

By Volta Torrey

PS photos by Hubert Luckett

WESTINGHOUSE engineers are preparing now to assemble the U. S. Navy's first atomic engine. It will be the first nuclear reactor designed to turn a propeller.

This one, its sponsors say, will never go to sea or take an airplane off a runway. It is to be permanently based on the Atomic Energy Commission's new Reactor Farm in Idaho, 600 miles from the ocean. But some day this reactor may be as highly valued an historic treasure as the Wright brothers' first airplane—because it is expected to be the prototype of many propulsion units that will be run with fissionable atoms just like those now put into bombs.

Engines of this type may add tens of thousands of miles to the cruising ranges of ships. Running such engines, moreover, will be quite simple, and blowing one up will be extremely difficult—yet each one will have to be imprisoned like a criminal.

Heavy walls will surround this engine because those strange little things that the physicists call neutrons are to be used in it, to split atoms, to produce heat, to turn a shaft. Having too many neutrons at large is so unhealthy that they must be firmly con-

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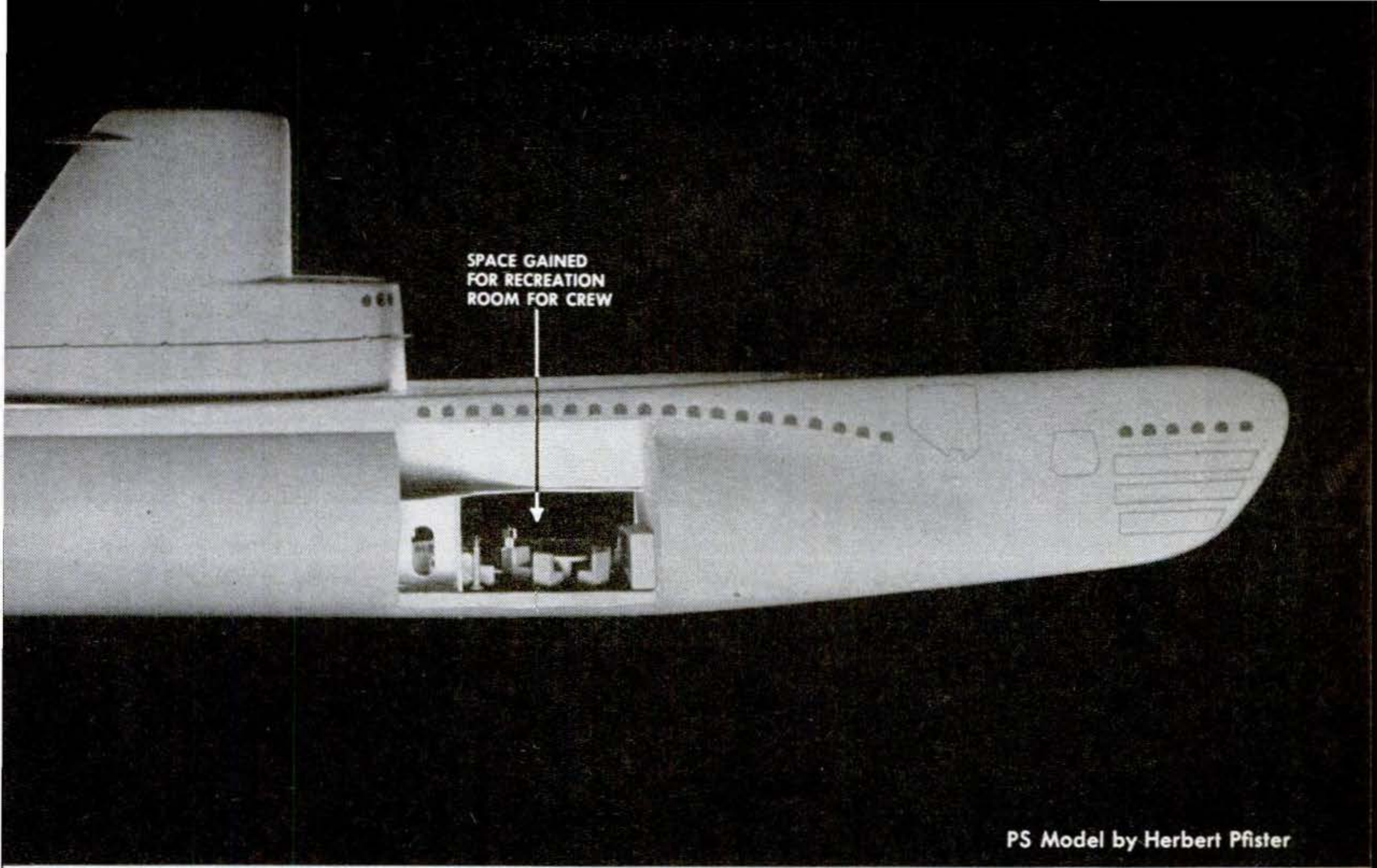


This model shows arrangement Dr. Clark Goodman discusses in new nuclear-power textbook.

fined—but their somewhat-human traits tend to make them very obliging prisoners.

Some neutrons are always late for work, and when given a chance nearly all of them quickly desert the chain gangs into which men put them. This is what makes it easy to slow down an engine in which they are the firemen.

But even while some neutrons are working diligently, others are sure to cause trouble. Atoms become pregnant because of neutrons, and have children and grandchildren. The neutrons, meanwhile, change their identities and disappear. This mischief is responsible for what you and I call radioactivity—and too much of that, as you know, is not good for human beings.

These are some of the facts that reactor builders must ponder.

For the Next 18 Months

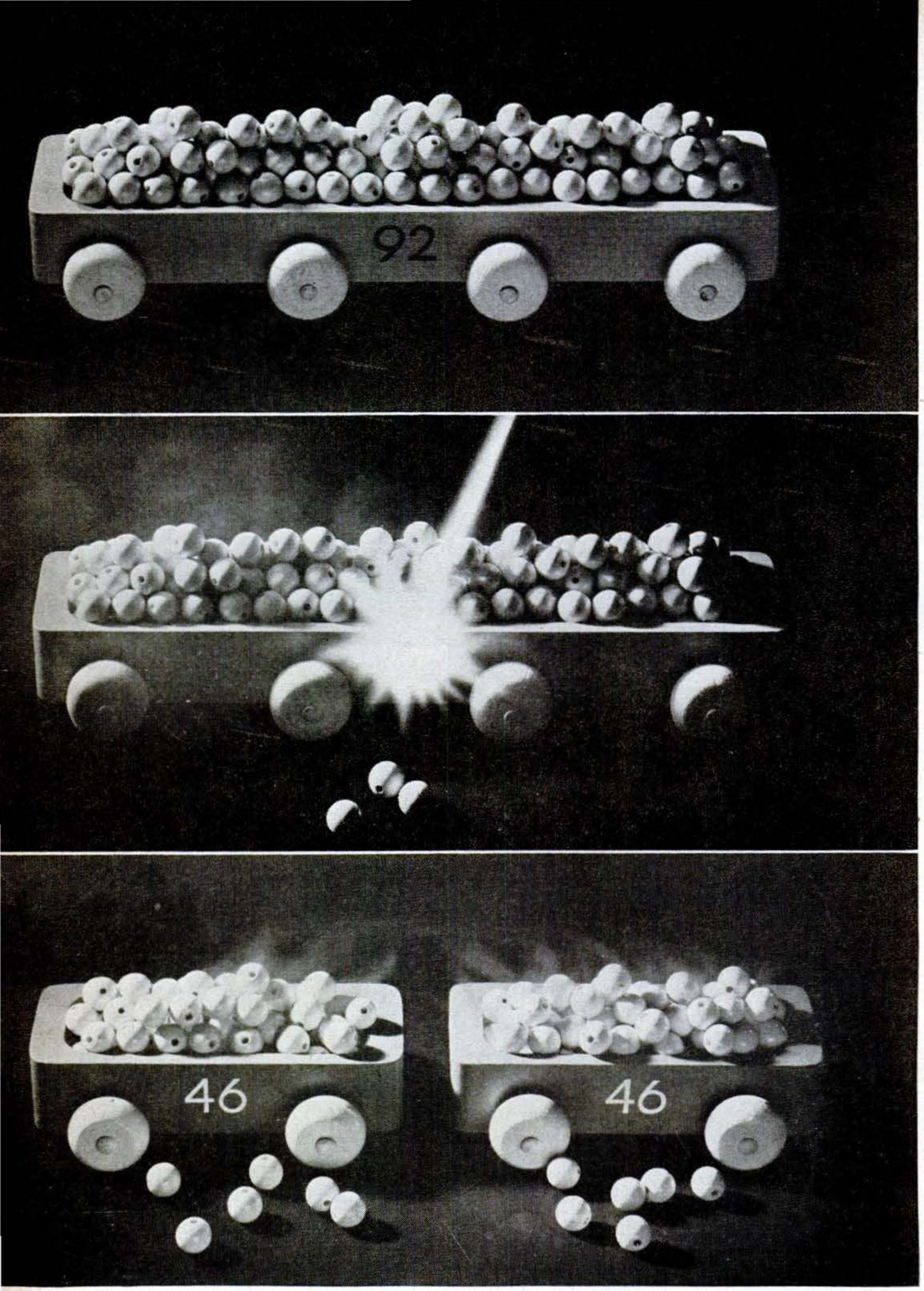
The AEC plans to build only four reactors during the next year and a half. Two will be breeders, intended to produce more nuclear fuel as well as power (PS, June '49, p. 124), and one will be a special type designed to test the metals, ceramics, and liquids that the engineers would like to use in future models. The fourth reactor—and the only one designed to produce a specific amount of power for a specific purpose—will be the Navy's propulsion unit.

Plans for this mobile type will be completed in a new, 600-man Westinghouse laboratory near Pittsburgh. Before it is put together, construction of the materials-tester will be under way in Idaho, and by the time it is finished more will be known about what must be done in order to put similar nuclear engines into ships, planes, and rockets.

Neutrons Depend on Partners

The engineers believe now that a shielded atomic engine, very little heavier than the engines, burners, and tons of oil now carried by some naval vessels, can be developed fairly soon. Later, it may be possible to make one light enough for huge aircraft. But mountains of work remain to be done because of the neutrons' peculiarities.

No way is yet known of extracting great and useful amounts of energy from the nuclei of atoms without the help of neutrons. They are the heaviest things in atoms, and they stick together tightly in nuclei. To do this, however, they need partners. Those partners are protons.



Atomic nuclei are vehicles for neutrons. A nucleus with 92 protons can retain 143 neutrons, as in cart at top. Splitting the nucleus with another neutron, as in center picture, knocks a few neutrons out, but leaves the two nuclei that are then formed overloaded with neutrons. A nucleus with only 46 protons cannot permanently retain more than 64 neutrons, so some are tossed out belatedly by many overloaded nuclei. Delayed arrival of those neutrons makes it easy to control the rate at which the temperature of a reactor rises.

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The number of protons in an atom limits the number of neutrons that can remain forever in its nucleus. A lot of protons can bind an even larger number of neutrons together. But when the number of protons is reduced, the number of neutrons that can stay in a nucleus with them is often reduced considerably more.

An atom of Uranium 235, for example, has 92 protons and 143 neutrons. But an atom with only half that many protons (46) cannot permanently accommodate more than 64 neutrons, which is less than half (71.5) of the number of neutrons in the uranium atom.

A nucleus that is overloaded with neutrons behaves, at first, like any other kind of overloaded machine or man. Instead of collapsing instantly, it usually wobbles along for a while. Nevertheless, sooner or later, the machine must be strengthened or some of the load must be removed.

Wobbling Explains Radioactivity

Physicists call atoms that contain too many neutrons "unstable." This instability, or tendency to wobble, makes them radioactive. And that is simply a scientific way of saying that something is sure to happen to them.

An unstable nucleus may strengthen itself by giving birth to a meson—one of the marvelous things that scientists are now studying very intently. Within the nucleus, this meson may turn into a different kind of meson, which may give birth to an electron. And if you were to examine an atom after such changes inside of it, you would find that it had become an atom of a different element, because an additional proton would have appeared in it, and one of its neutrons would have vanished.

But, as you might well imagine, having a child and a grandchild takes time—and a wobbly, overloaded nucleus often can stabilize itself more simply by throwing off part of its neutron burden. Several kinds of radioactive atoms just heave a neutron out when they are overloaded.

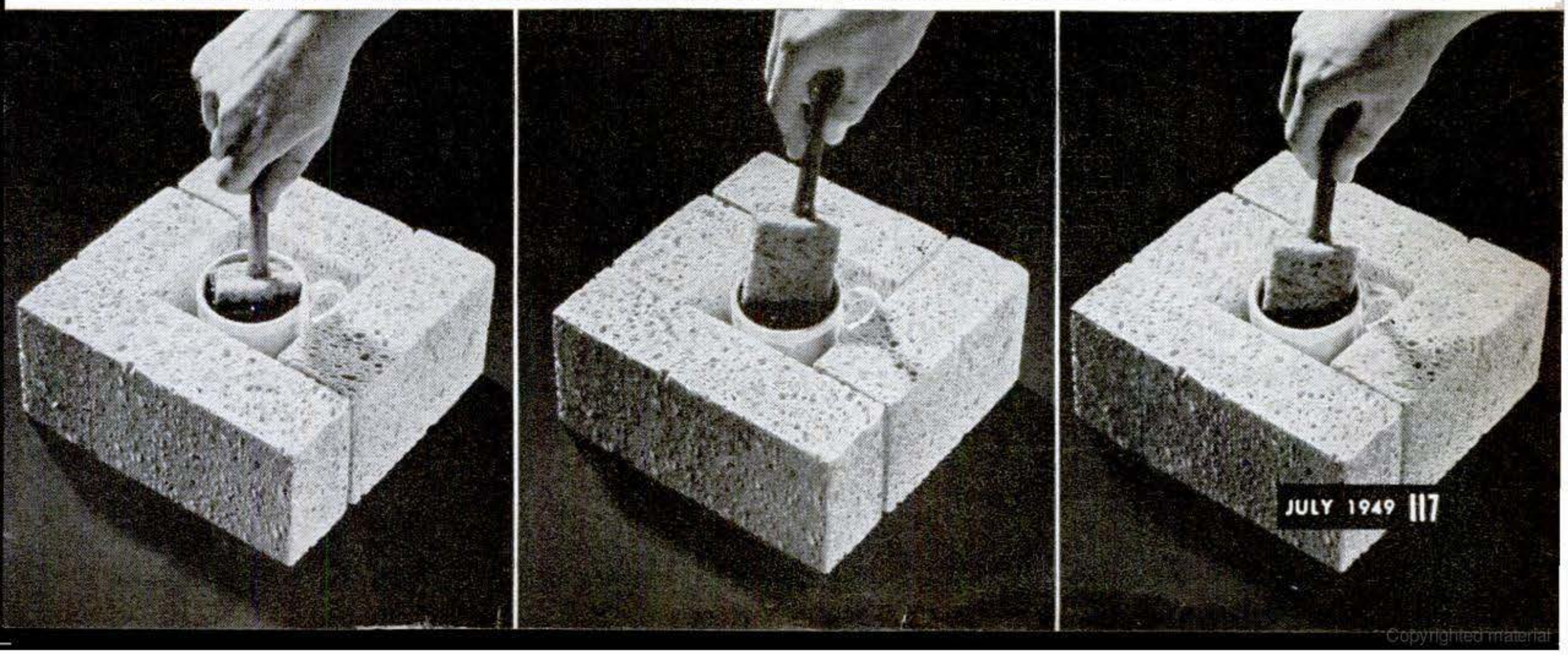
The neutrons that are tossed out intact but tardily by the new atoms created when atoms of Uranium 235 are split are politely referred to by reactor experts as "delayed" neutrons. They tend to make nuclear reactors sluggish and, consequently, are extremely helpful, because the sluggishness of reactors makes it quite easy for men to control them.

What Will Be Cooking

If you could look into the boiler of the engine now being designed for the Navy, and see with the help of some impossibly powerful microscope what the physicists say will happen in it, you would see hordes of free neutrons splitting enormous numbers of atoms of Uranium 235. The free neutrons would virtually never break one of those atoms into two equal halves. Instead, they would break the big atoms into smaller atoms of tin, antimony, arsenic, zinc, and about two dozen other elements—but nearly all of those new atoms would be overburdened with neutrons. If one was not, the other one that had come out of the same uranium atom would be very seriously overloaded.

Those new atoms would contain too many neutrons because only a few of each uranium atom's 143 neutrons would have been knocked out when the big atom was split. Most of its neutrons would cling with the protons in the nuclei of the newly formed lighter atoms. But the protons of ➧

To show your friends how a nuclear reactor is controlled, surround a coffee cup with sponges to represent shielding and insert another sponge to represent control rods. Drawing the rods out permits the reactor to start. Shoving them back in retards it because they "absorb" neutrons.



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those new atoms would not be able to hold so many hangers-on together forever, and in the course of time quite a few of them would be thrown out.

If you could focus your imaginary super-super-microscope on a single atom's nucleus, you might find that it was an overloaded and shaking bit of bromine—an element familiar to chemists as a reddish-brown, evil-smelling liquid. By having meson descendants within its nucleus, this atom might turn a neutron into a proton, and become an atom of krypton, which is one of the rare gases in the atmosphere.

But, if you looked very, very closely, you might find that this krypton atom was unstable, too. If it went on having children and grandchildren, it eventually would become an atom of rubidium, a soft, silvery-white metal.

That excited krypton atom, however, might practice birth control and stabilize itself by simply hurling out one of the neutrons responsible for its agitation. No one has ever seen a krypton atom do this, and no one ever will. But the physicists can prove that, whenever a great many atoms of Uranium 235 are split, neutrons will emerge tardily from several kinds of radioactive fragments such as that krypton atom.

They even know, in fact, how many neutrons can be counted on to be unavoidably delayed: one percent of all the neutrons freed will not appear until a hundredth of a second or more after the Uranium 235 atoms have come apart. A substantial number of them will be about eight seconds late, and some will be a whole minute behind time.

The Dragon at Los Alamos

Ingenious and daring experiments were performed to find this out. Prof. O. R. Frisch and his assistants at Los Alamos almost produced a bomb, momentarily, in a device that they called the Dragon. In it, a slug of Uranium 235 was allowed to fall through a hole in a larger chunk of the same material resting on a table.

While the slug was going through that hole, millions of neutrons popped out and broke a great many Uranium 235 atoms. But the slug passed on, through a hole in the table into a box beneath the table, before enough neutrons had gotten out of the fission fragments to split enough more atoms to cause trouble. F. de Hoffman, B. T. Field, and B. R. Stein examined this slug, found that neutrons still were coming out of it, and counted them.

The tardiness of such neutrons made it difficult to design a bomb, but comparatively easy to design controllable reactors. None of the latter has **exploded**, because the delayed arrival of some of the neutrons always gives the operators of such reactors —and the electrical devices that aid them —ample time in which to act whenever things start to happen too fast.

The Spoon in the Cup

The "neutron flux" in a controllable reactor is regulated very simply. If you have eaten frequently in railroad dining cars, you probably have learned to reduce the danger that your coffee will be spilled by leaving your spoon in the cup. The spoon retards the rate at which the waves in the liquid can grow higher and thus become big enough to pass over the cup's rim. Something better than a spoon, however, can be left in a nuclear reactor.

There are materials that absorb neutrons as readily and even more quickly than sponges absorb water. Rods made out of those materials are run through the reactors. They make it possible to control the rate at which the number of neutrons at work rises, and thus regulate the temperature of the reactor.

To start the Navy's atomic engine, some of those rods will be drawn out. To allow more neutrons to split more atoms, another rod will be partially withdrawn. And to slow the reactor down, by reducing the number of neutrons on the job, one or more of the rods will be shoved back in far enough to absorb as many of them as necessary. Those rods may even be adjusted automatically by devices comparable to the thermostats that regulate ordinary furnaces in many homes.

"To keep a pile running at a steady rate," says Enrico Fermi, who built and ran the first one beneath a stadium in Chicago, "is an art that can be mastered in a few hours." Hence, every man in the crew of an atomic-powered ship may learn to apply the brake.

But might not an enemy's bomb or shell cause an atomic reactor to blow up?

This would be highly improbable because (1) the same shielding that would protect the crew from radioactivity could serve as armor to protect the atomic boiler, and (2) that boiler could be so designed that loss of control of its temperature would result

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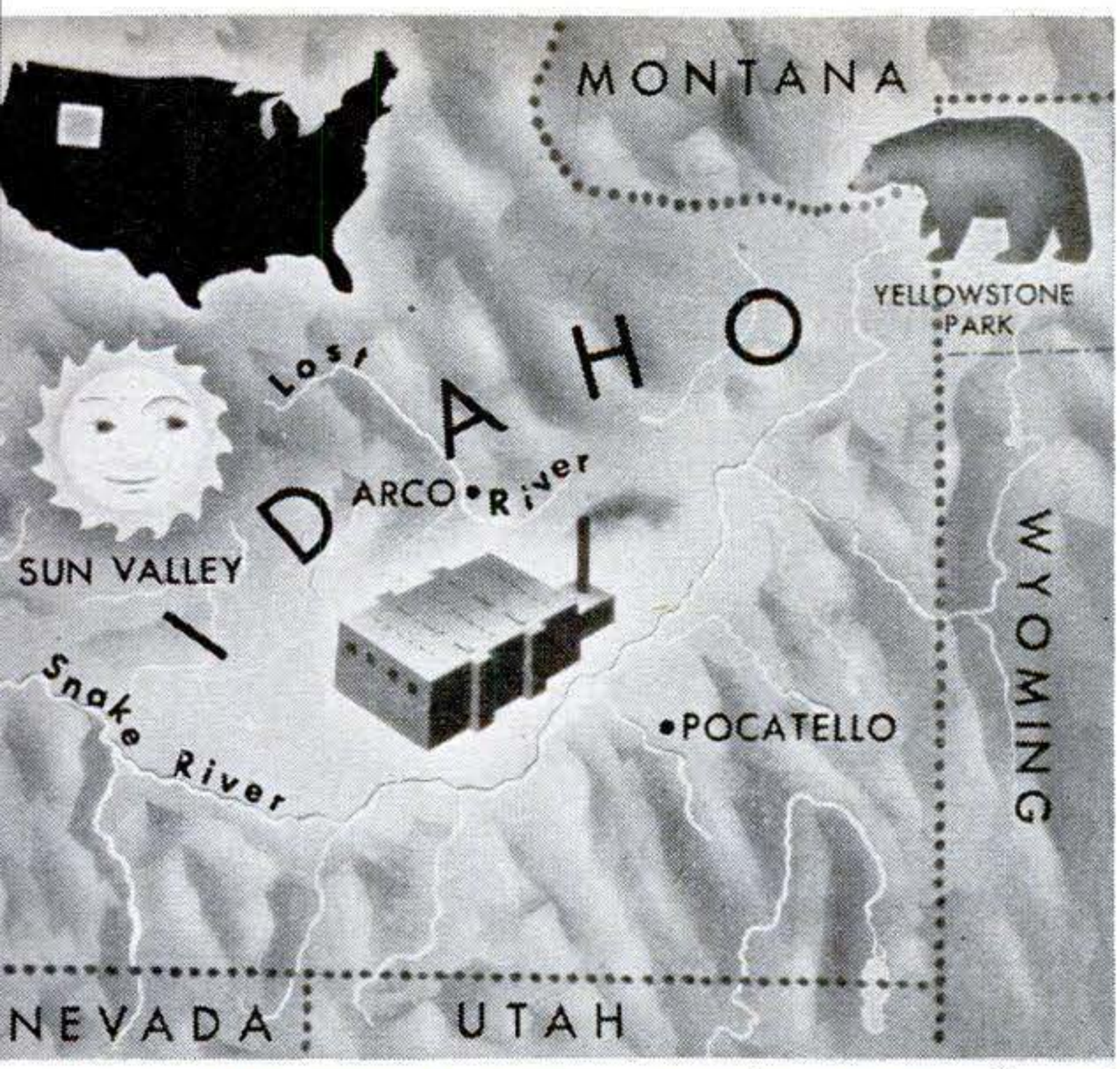

New reactor station in Snake River Valley of Idaho will cover 625 square miles. A materials-tester and a propulsion unit for the Navy will be first two reactors built there. Eventually, many more experimental atomic engines may be tried out in this scenic area of the Rockies.

only in a big fizzle. It could, in fact, be made less liable to blow up than other parts of a ship.

Although uranium has been mined for eight centuries, and used to color crocks, imitation jewels, and the caution lights in traffic signals, there is no record of it ever having exploded except under conditions that are hard to bring about.

Why Reactors Are Big

Puncturing the casing of a controllable atomic boiler would let neutrons escape and tend to reduce the rate at which it produced heat. But those neutrons, and the other radiation that would zoom out with them from the unstable atoms in the reactor, might be very harmful to people.

The shielding that protects people is what makes most controllable reactors big and cumbersome. Ways to reduce its weight may be found with the help of the specially designed materials-tester soon to be built.

A second reason for the immensity of some reactors is that they are run with uranium that contains only a small percentage of fissionable atoms. But the Navy reactor is to be run with fuel that has been "enriched" with such atoms. Hence, its boiler may be quite small.

In this respect, it will be a sister of the two smallest reactors now running. Both are at Los Alamos. One is called the Water Boiler because its fuel is fed to it in liquid form. The other is called Clementine, because its diet is Plutonium 239, for which the wartime code name was "Forty-niner."

Atomic Submarine First

The Navy engine's fuel tank—which will also be its boiler—will have to be taken out periodically so that the fragments of broken atoms can be removed, and fresh, fissionable atoms inserted. But the tank will not be noticeably lighter when its contents have been used up than when they are fresh because, despite the tremendous amounts of heat that this fuel yields, only a tiny fraction of its weight will be converted into energy.

The first actual installation of such an engine, many engineers believe, is likely to be in a submarine. There it would be especially advantageous because nuclear fuel can be consumed without oxygen. In a submarine, moreover, tons of batteries and fuel might be found to be unnecessary.

Suppose that such submarines, roaming the seven seas, and remaining submerged as long as their crews were willing, also were equipped to plant atomic mines or flip atomic projectiles into areas like Pearl Harbor . . .

Suppose, too, that men continue to make the planes that carry bombs bigger, and nuclear reactors smaller . . .

These grim thoughts are not ridiculous. Millions of dollars, from your pockets and mine, are being spent to make developments of this sort possible—and the only alternative is to persuade the leaders of other nations that atomic energy must be controlled internationally. END

Rhenium Metal Found Radioactive

As PREDICTED but not previously confirmed, the rare metal rhenium has been found to be naturally radioactive, Prof. W. F. Libby, of the University of Chicago, reports. Belonging to the manganese family, this heavy, silvery metal has been used in special lamp filaments and as a chemical catalyst. It now becomes one of a few known examples of naturally radioactive elements outside the well-known uranium-radium and similar families. Others include naturally radioactive isotopes of potassium, rubidium, samarium, and lutecium, and more may be discovered, chemists foresee.

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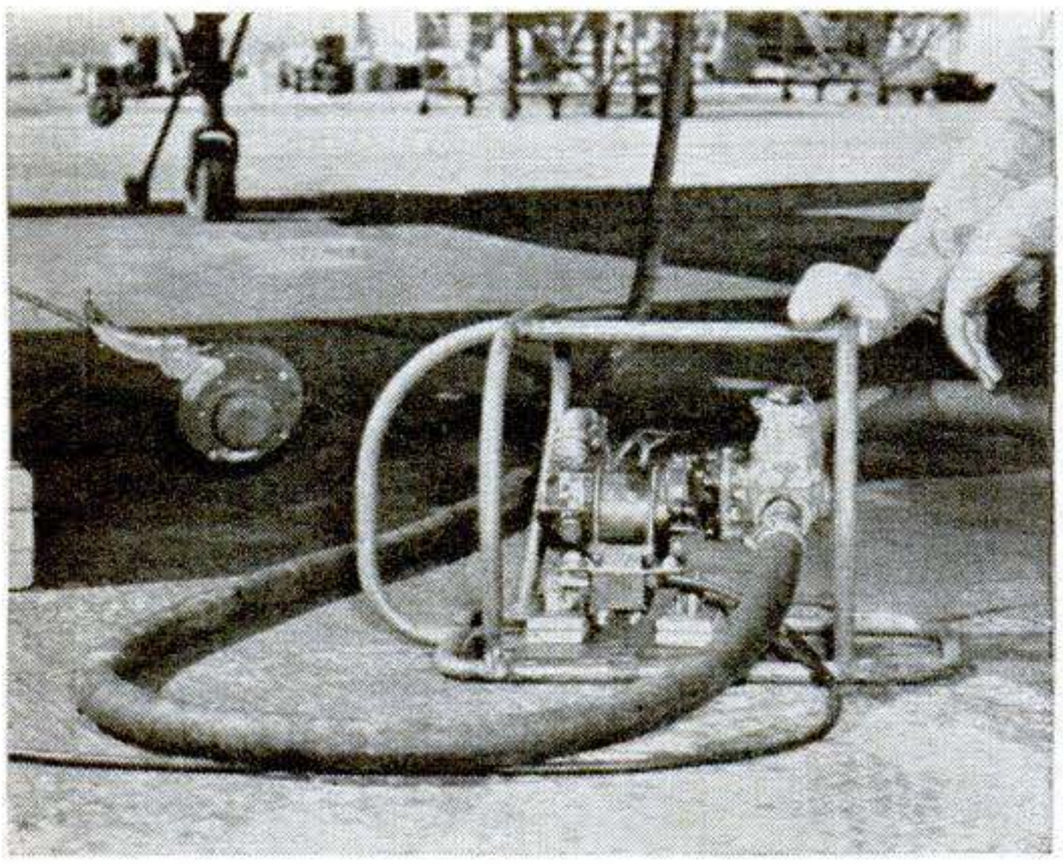
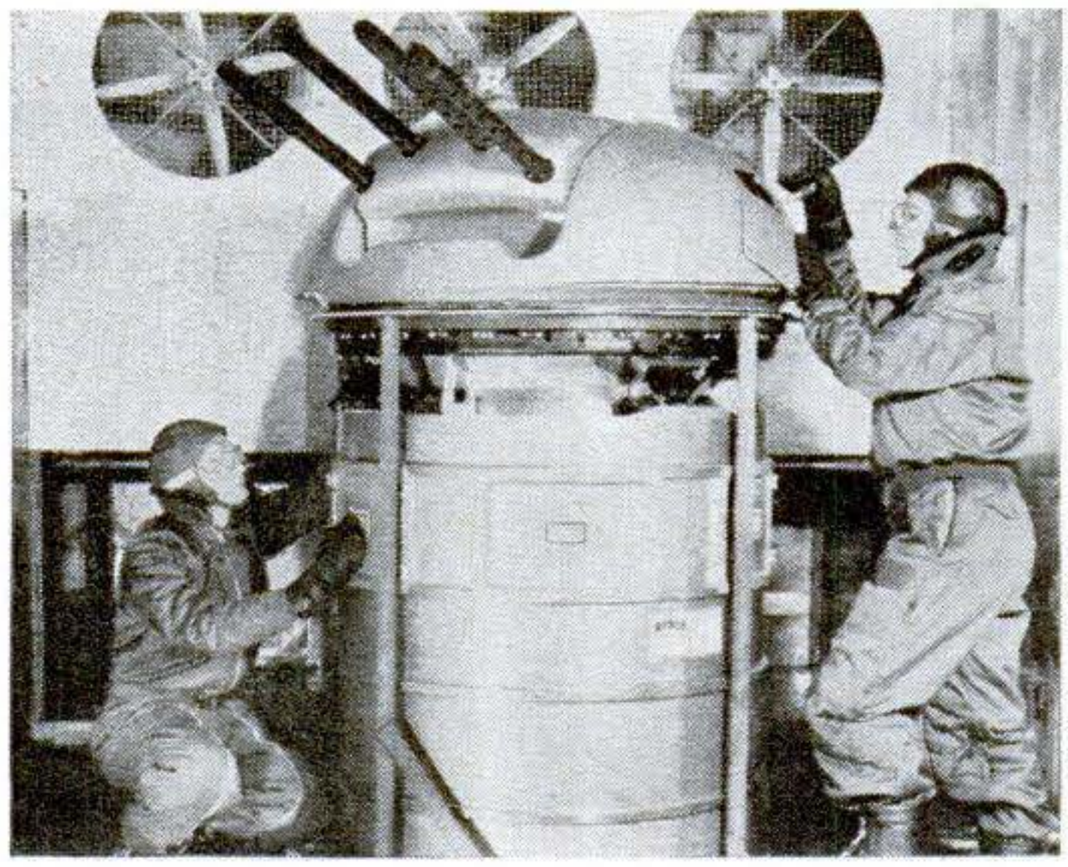
What's New in Aviation

Going Up in a Bubble. Three passengers fit comfortably in the wide seat of the latest Bell-47D1 helicopter shown above. A 40-percent increase in payload to 500 lb. was achieved by reducing the rotary-wing craft's empty weight by 150 lb. This decreased weight also permits the new model, say the designers, to hover motionless at 10,000 feet—double the previous altitude—for mapping and other surveys.



Drains Tanks in a Hurry. Emptying aircraft fuel tanks is now just a 15-minute job at the Marine Corps Air Station, El Toro, Calif. Thanks to the homemade, portable unit above, invented by M/Sgt. Eddie Reynolds, repair work need not wait for a "de-fueling" gas truck to be available. The 80-lb. machine, built of salvage parts including an electric transfer pump from an old Corsair, can be reversed to fuel planes.



Turrets Get Freeze Test. Wearing "storm suits" to protect them against temperatures as low as 65° F. below zero, General Electric engineers test gun turrets that will go into new models of the Air Force's 400-m.p.h. B-50 bombers. In addition to being checked for the effect of low temperatures encountered at 40,000 feet, the turrets are subjected to strains simulating high wind velocities of actual flight.

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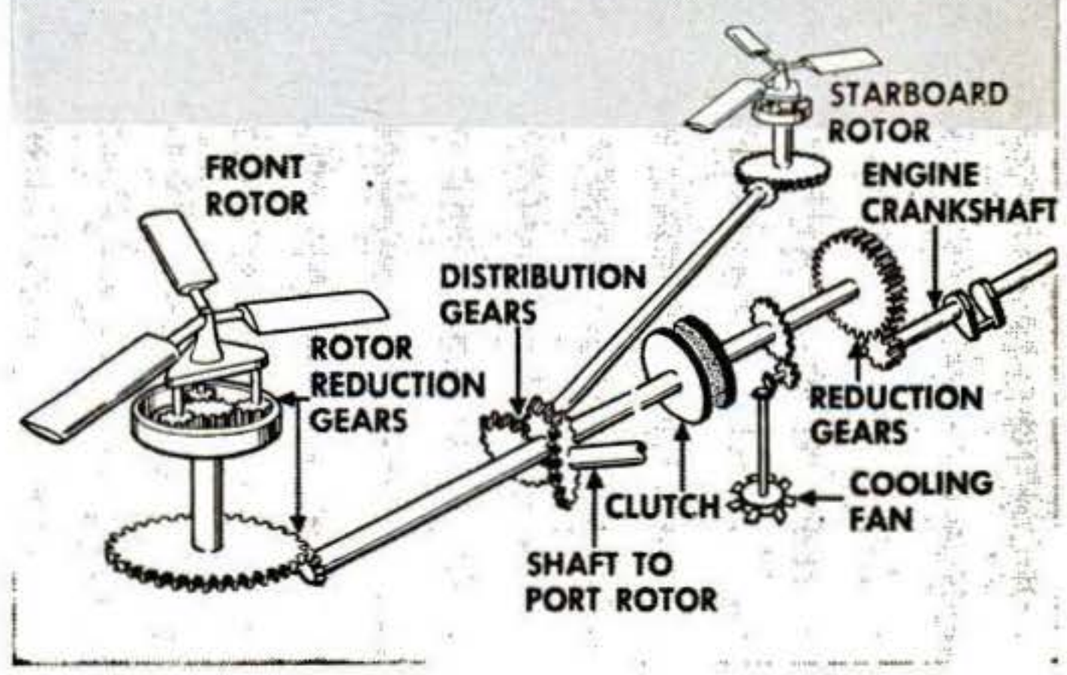
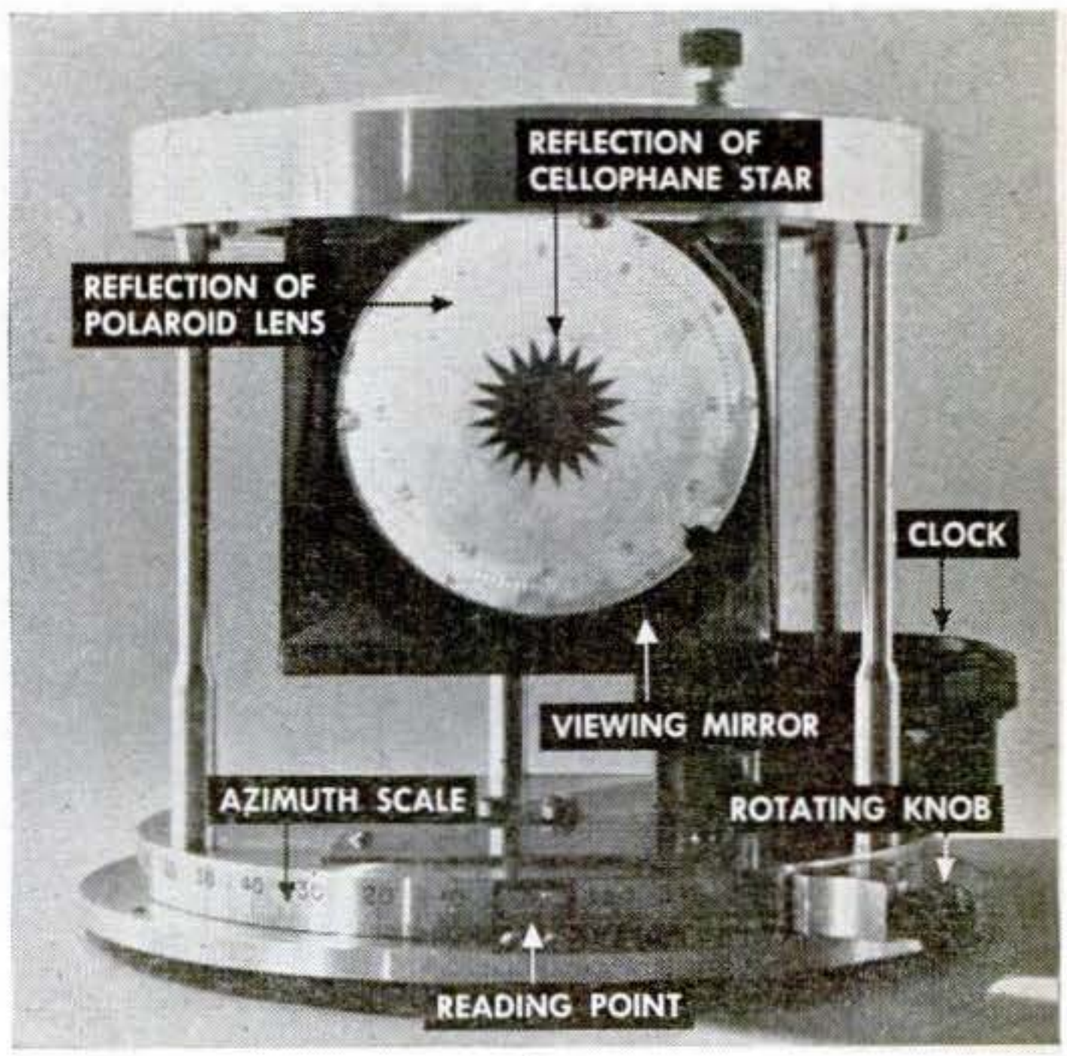
Big 'Copter Lifts Big Load. The Cierva "Air Horse," Britain's first freight-carrying helicopter, is designed to lift three tons of cargo or 24 passengers, plus a two-man crew. Its three rotors, geared as shown at right, are powered by a Rolls-Royce Merlin® 1,600-hp. engine, and give it a top speed of 154 m.p.h. The landing gear is built to absorb vertical shock if the engine fails below 150 feet. Above that height, autorotation (windmilling) provides enough lift for a conventional power-off landing.



Sky Compass Aids Polar Flight. This Navy compass works where other navigation aids fail—near the magnetic poles at times when neither sun nor stars are visible. Heart of the device is a Polaroid® glass lens with a clear cellophane star partially covering it. By rotating the lens until light from the sky seen through the Polaroid and cellophane is as bright as that seen through the Polaroid alone, the navigator can read the sun's direction on a scale. He then finds his direction of flight from tables. Developed by the National Bureau of Standards, the compass works because sunlight reflected by dust in the sky is polarized—vibrates in one direction—at right angles to the sun's direction. Thus, polarization angle tells the sun's direction.



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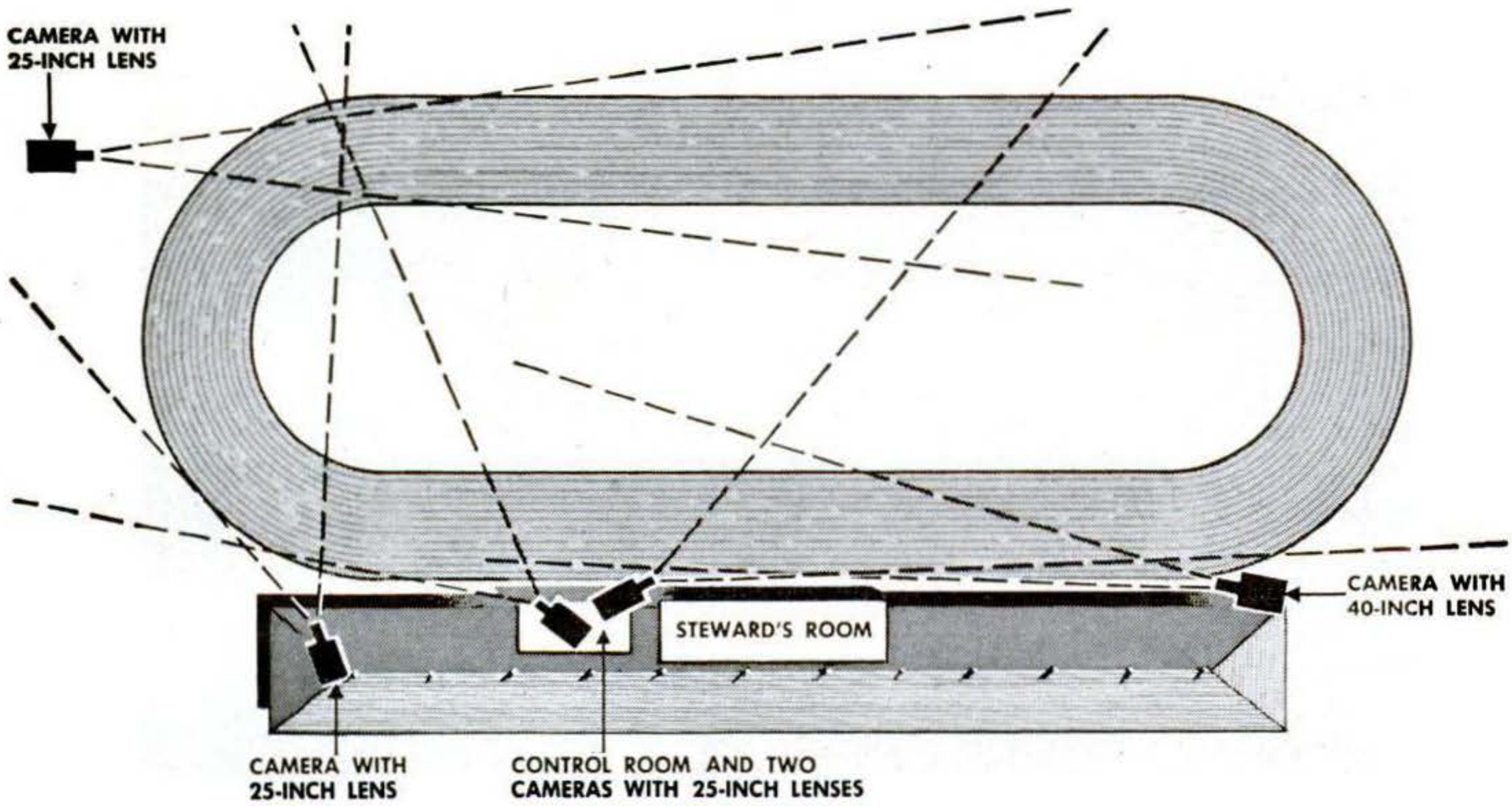
TV Follows the Horses to Spot Racing Fouls

Overlooking the track, booth at left houses two of the television cameras and the control monitors. Parabola atop booth relays the signal to the TV station for a broadcast to home sets.



Location of the five cameras for complete coverage of a race is shown above. Three cameras give head-on view of horses. Coaxial cables connect cameras, booth, stewards' room.

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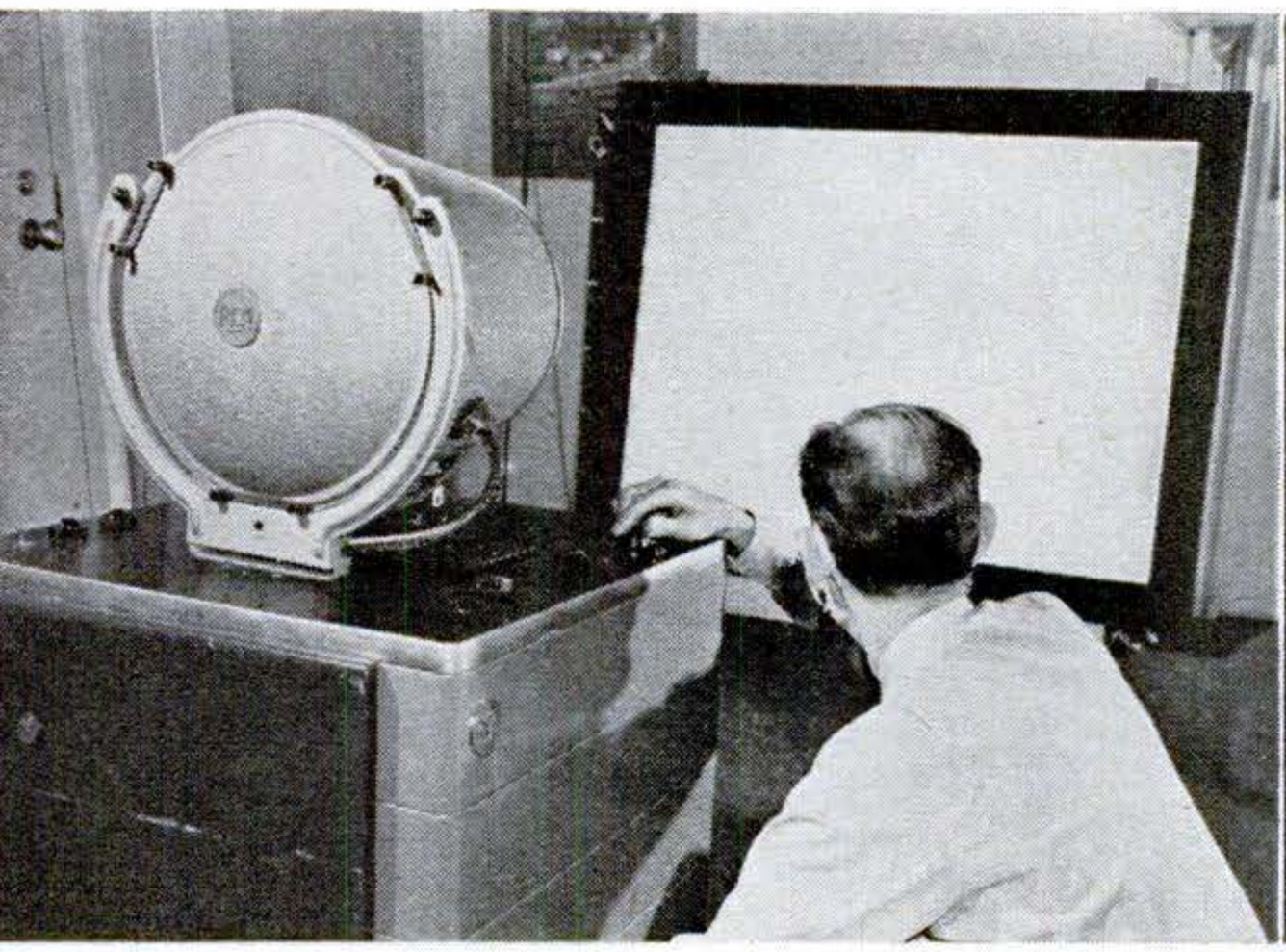
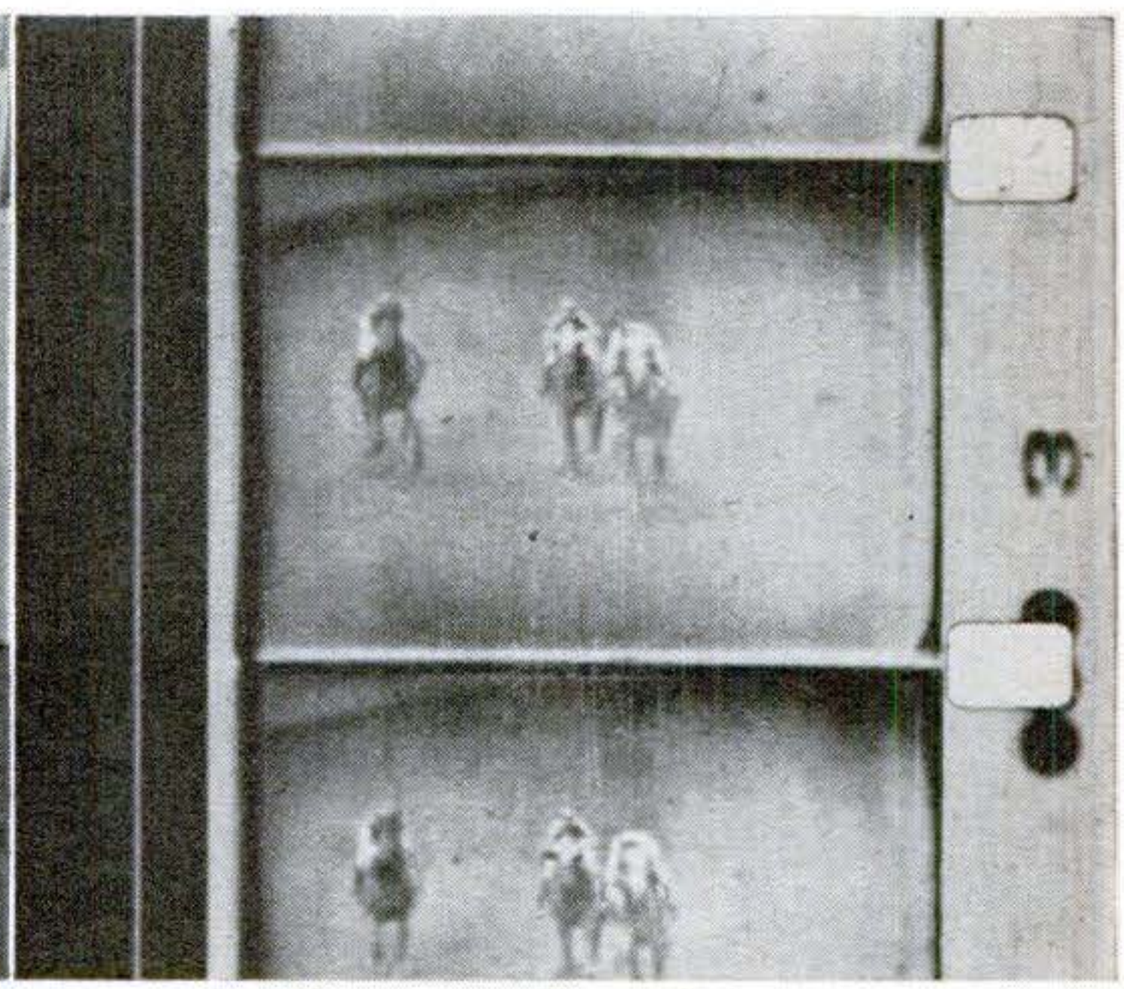
Inside control room, monitor hanging from the roof shows image selected for relay to track officials. Man seen at camera in this photo is televising the race for home video reception.

Each camera is connected to a monitor in the control room, showing scene it is televising. An engineer controls the light levels and selects image to be sent to the judges' viewing screen.



Progressively selected television views of the race are projected on this screen in the steward's room, giving complete picture from start to finish. Projector is an RCA-Schmidt type.



Sample film strip taken of the monitor screen shows head-on view of horses entering home stretch. In addition, a sound track carries an announcer's running description of the race.

By Harry Samuels

PS photos by Hubert Luckett

TELEVISION cameras came in a winner recently in trials for a new job at New York City's Jamaica Race Track.

In a test run, a battery of television cameras supplied track stewards with a close-up view of the horses from starting gate to finish line. Watching the race on a 32- by 44-in. silvered screen, they were able to detect any infraction of racing rules anywhere along the track.

Now the inventors are seeking the approval of the various state racing commissions. They point out that one minute after the race is over, the stewards can back up any charge of a foul with a 16-mm. movie-film record. A special motion-picture camera photographs the TV scope, and the film is processed in less than a minute (PS, Jan. '49, p. 141).

Although the system is intended primarily for on-the-track use, the TV pickup can be transmitted for home reception, reports Harry A. Rose, the inventor. END

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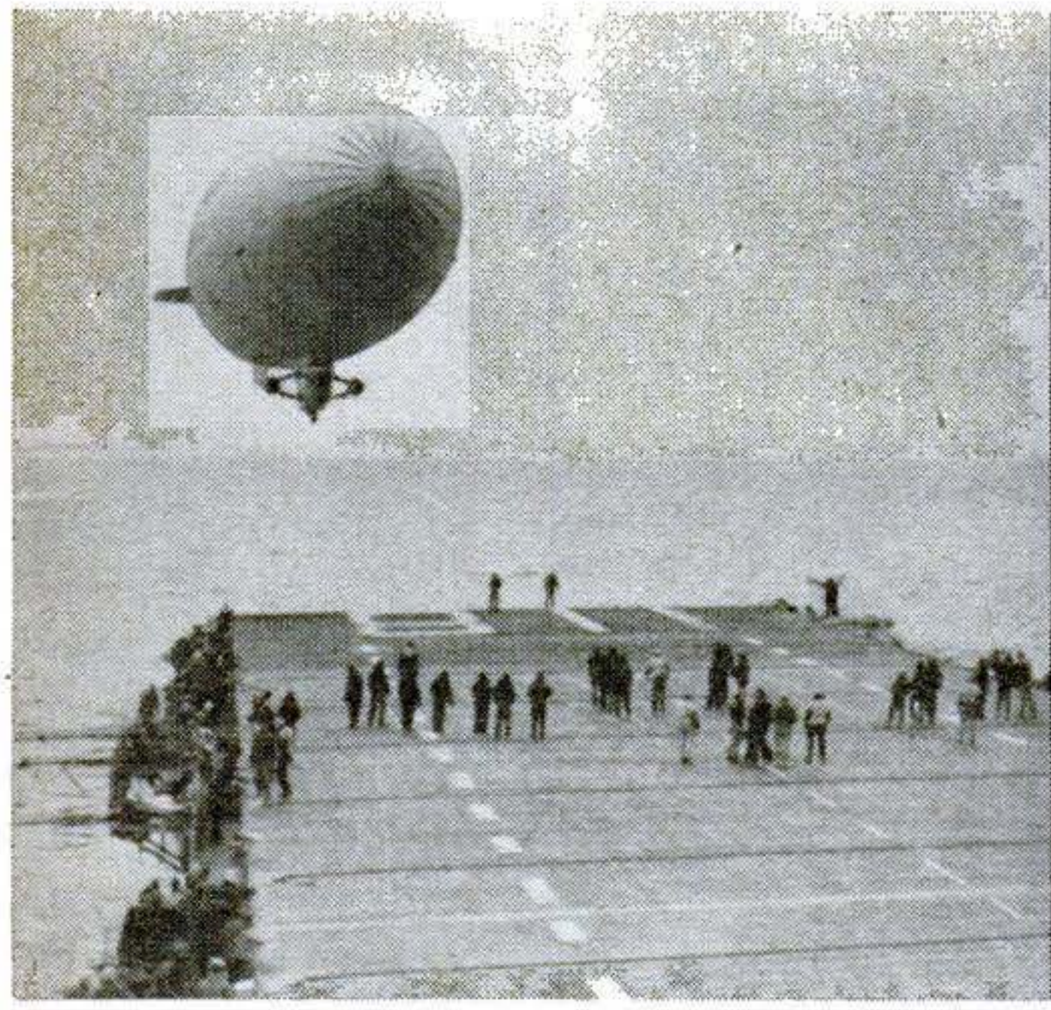
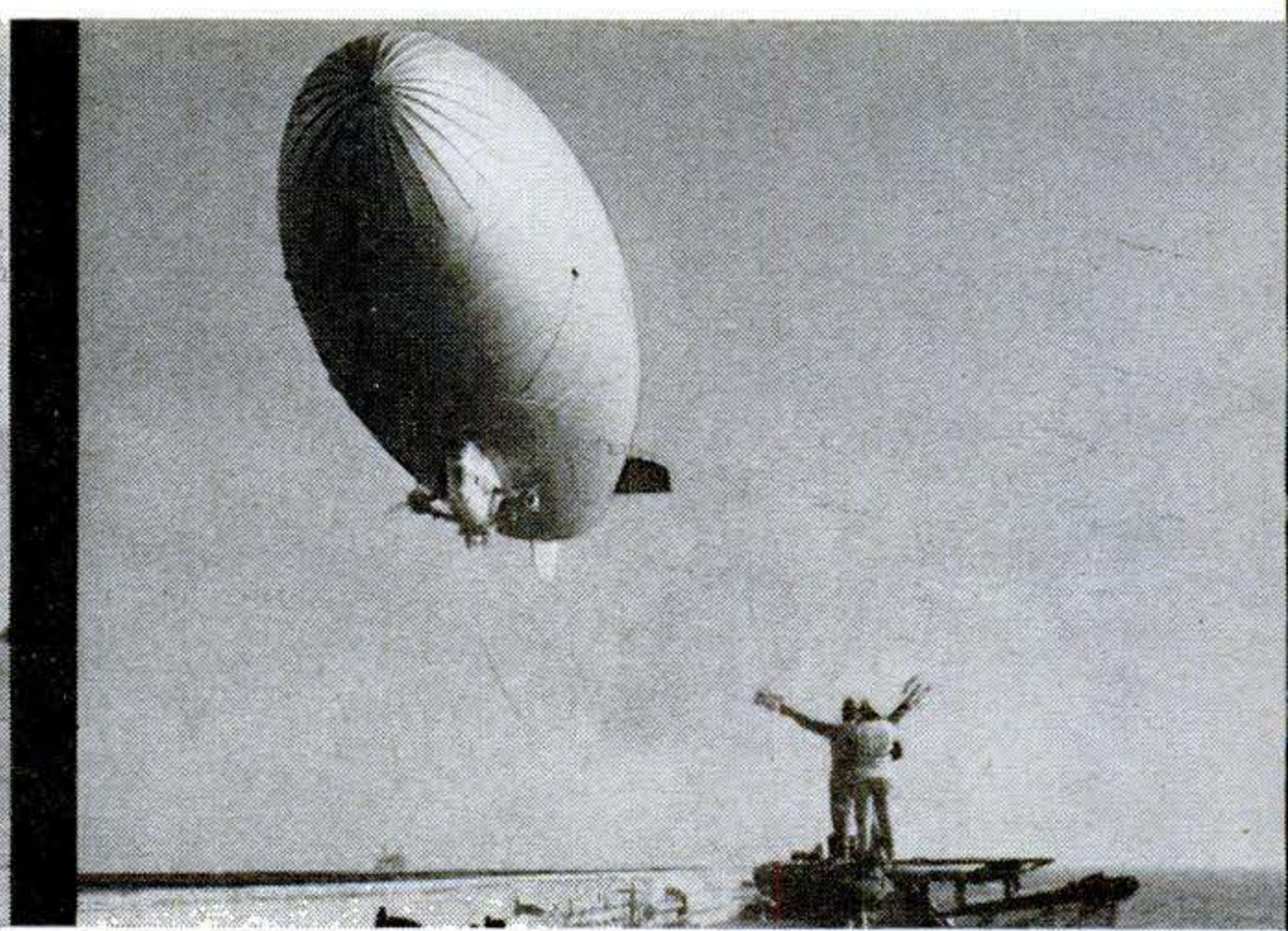
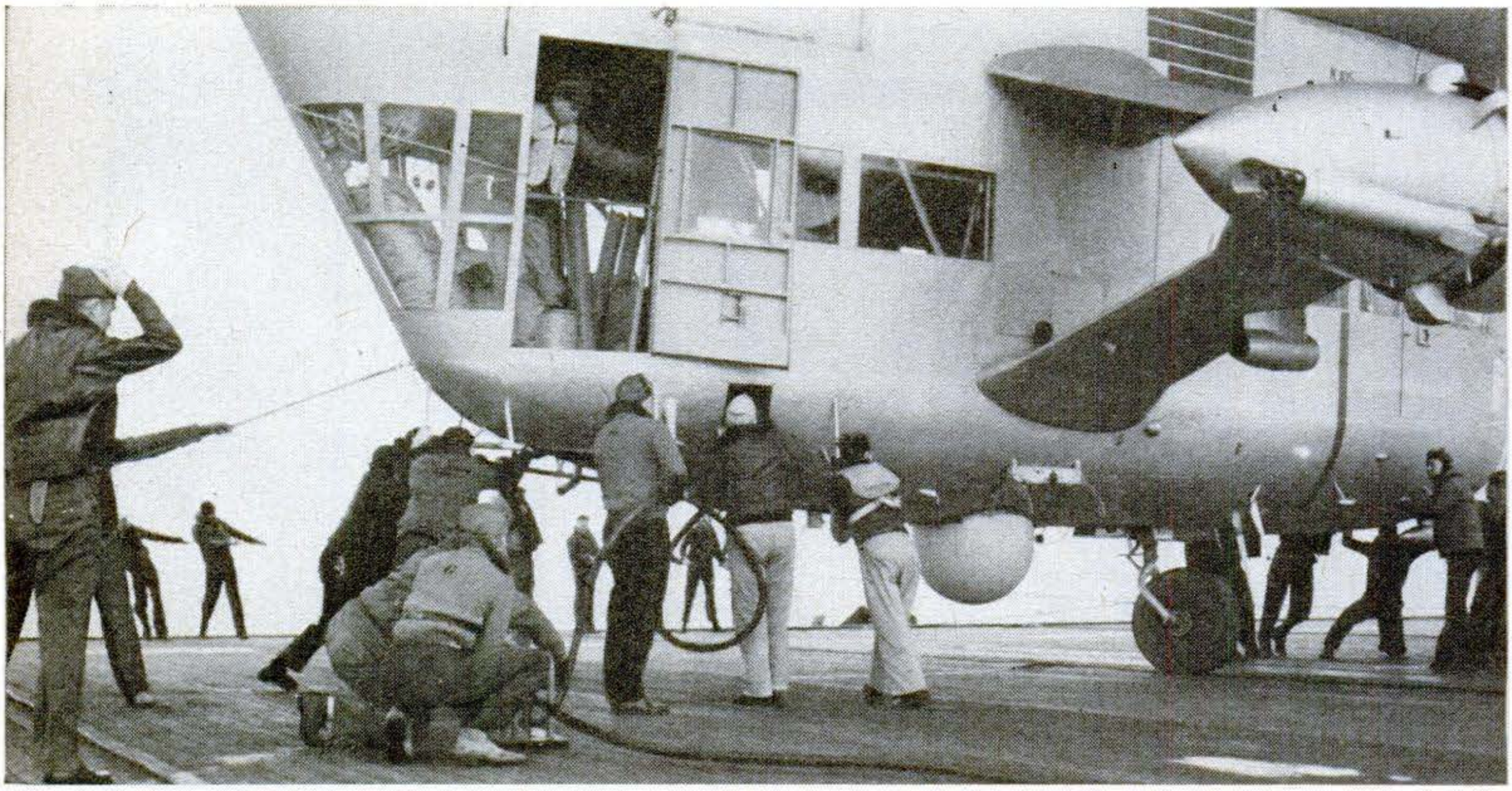


Coming up the groove. Blimp approaching carrier's flight deck makes a landing circle like airplane. And even though speeds are slower, landings on narrow strip are just as tricky.



Over the deck. Blimp is a little high for a perfect sit-down on carrier but is squared-off properly, according to the landing-signal officer's upstretched paddles. Lines trail from nose.



Gas and gas. A fresh crew is aboard, wearing only life jackets because blimps work too low for parachutes. Gasoline for the still-turning engines is hosed in as quickly as possible. Gas (helium) can also be supplied by the carrier. Note "human ballast" on the hand rails fore and aft. That big bundle in the stern (extreme left end of the car) is a rubber raft.

Carrier-Based Blimps Aid Sub Hunters

U.S. Navy photos aboard U.S.S. Sicily

TAKING the deck guns off submarines (PS, June '49, p. 98) has made the gasbag Navy a less vulnerable, more valuable sub chaser. A blimp can laze along just over the sea to give suspected water a good going over. Or it can speed up to 75 m.p.h.—far faster than any ship on or under the surface. And the big car has a lot of room for electronic search gear.

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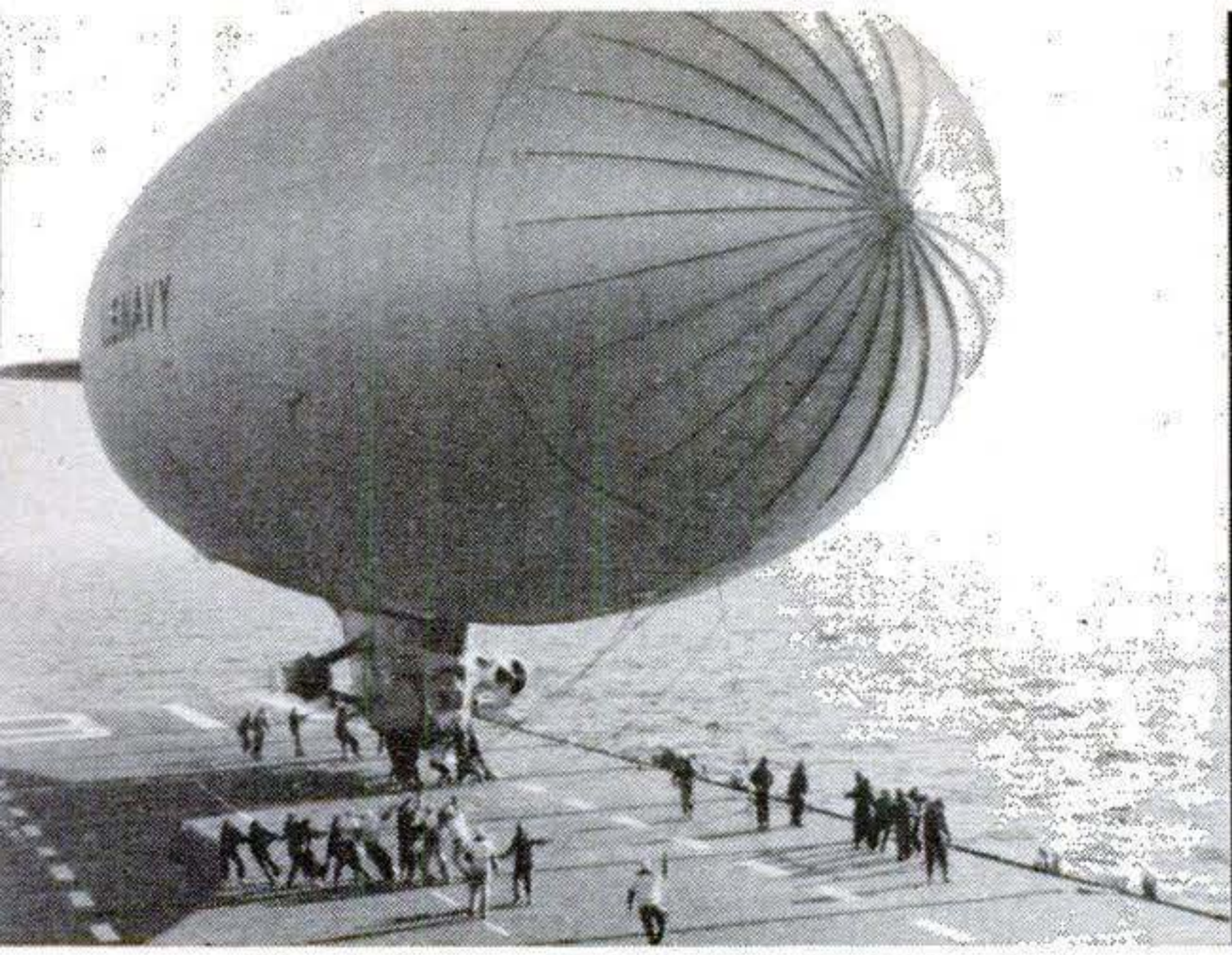
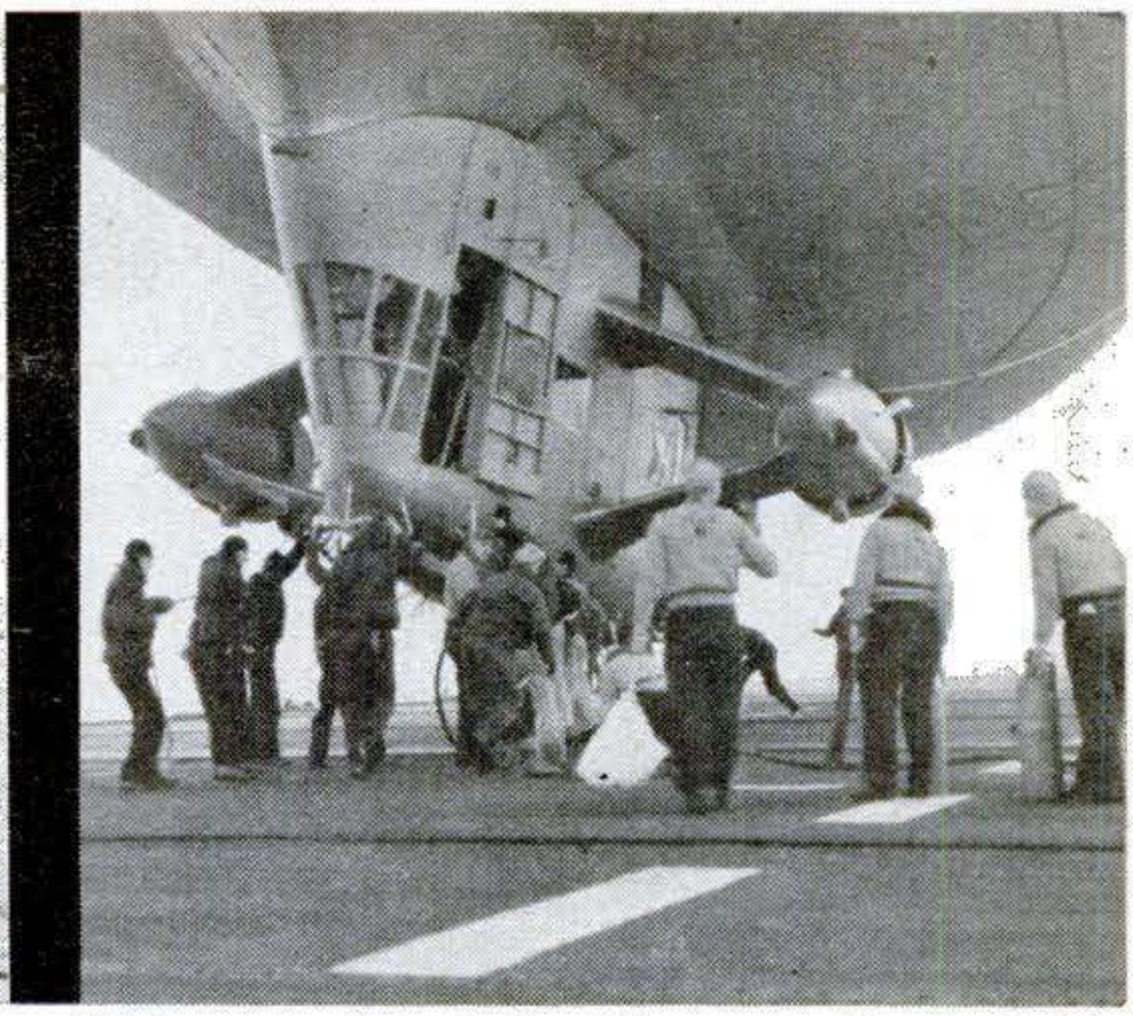
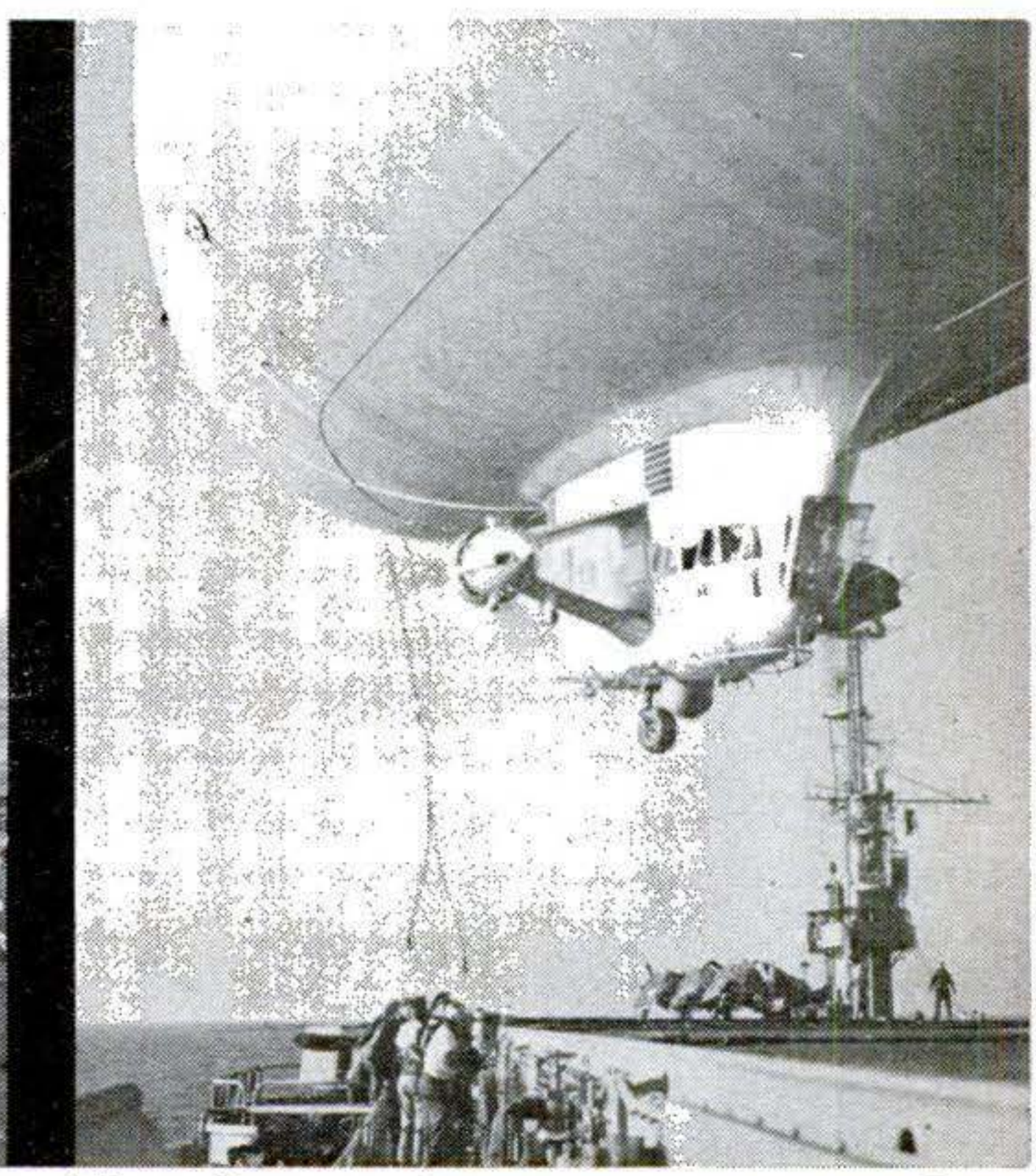


Touchdown: U.S.S. *Sicily*'s flight-deck crews grab blimp's dangling lines, muscle the delicately balanced gas bag to a landing on its single wheel. Propellers keep turning.



Flying on the deck. Pilot must keep airship flying all the time blimp is on the deck. Doing so with car almost on deck is tricky business when the wind shifts.

Stand by to launch! Hold-down men strain on the lines as man with "fid" (left) waits signal to pull his wooden pin holding lines. Man at right keeps axe ready for emergency.



There he goes. Motors roaring to gain flying speed, the big bag climbs sharply to get clear of the ship. Blimps are surprisingly nimble, but moment of launch is always hazardous.

The big disadvantage has been the short range of shore-based airships. Now the Navy is working on ways to base blimps on the carriers of hunter-killer task forces. Here are first pictures of the experimental operations in which blimps were kept out on patrol for days, far beyond normal cruising range.

For some anti-sub jobs, the blimps proved better than destroyers or airplanes. Because blimps need handling only twice a day, round-the-clock flight operations were simplified.

Supplied at sea with fresh crews, refueled, and re-armed, the "rubber submarines" will probably play an important part in anti-submarine warfare. Next step is some kind of retractable mooring mast on carriers for easier handling and to permit shutting down engines for maintenance work. END

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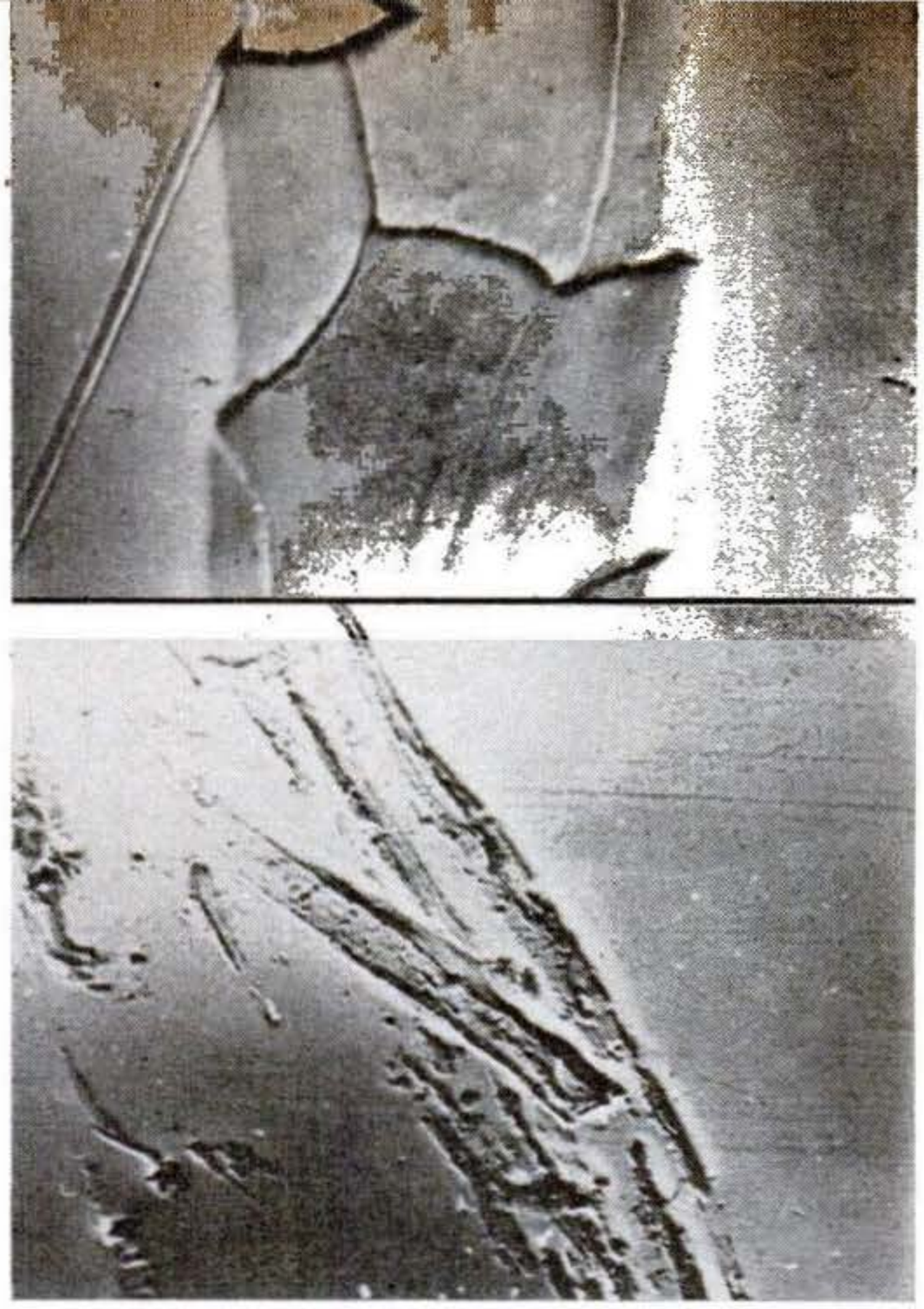
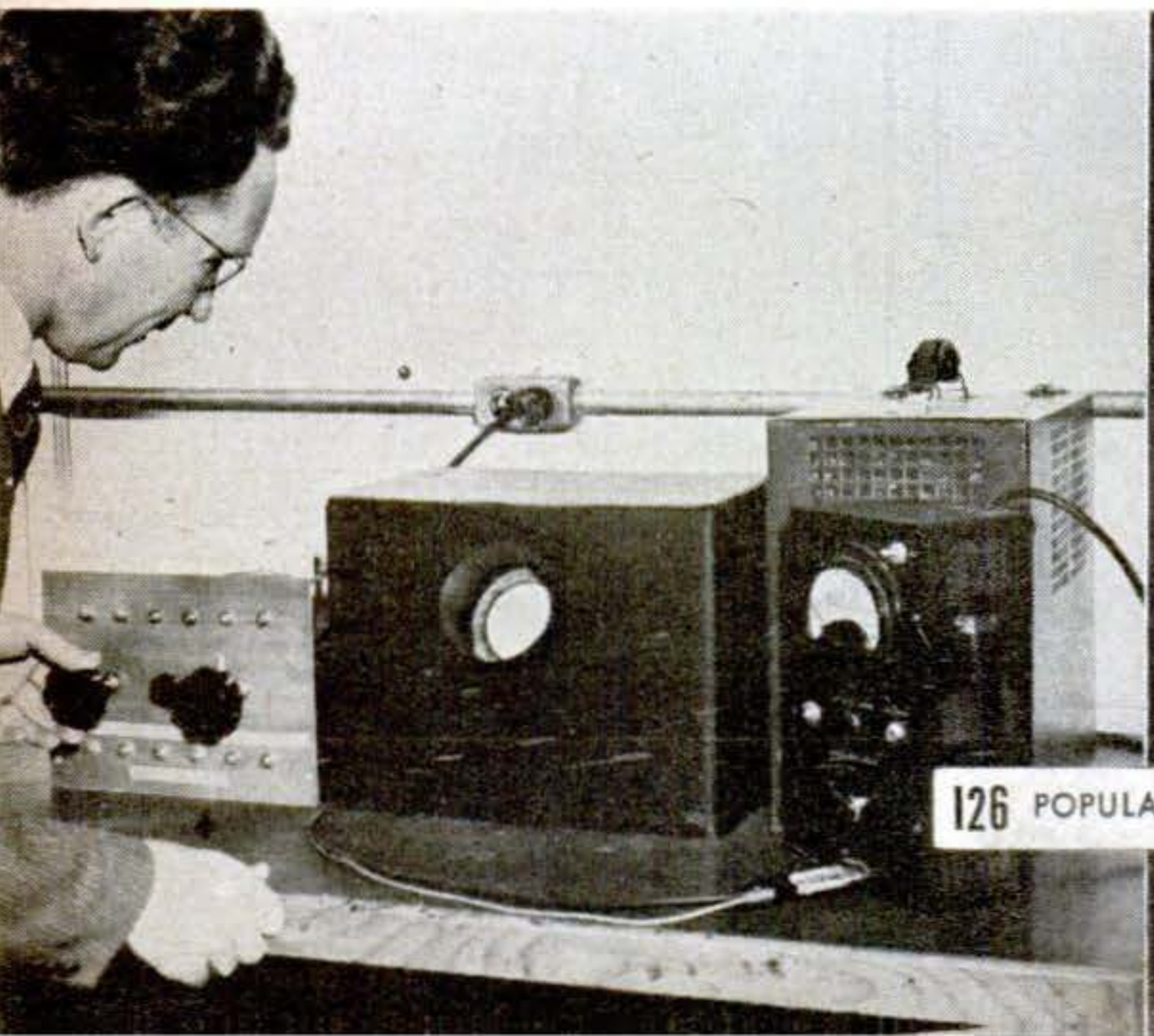
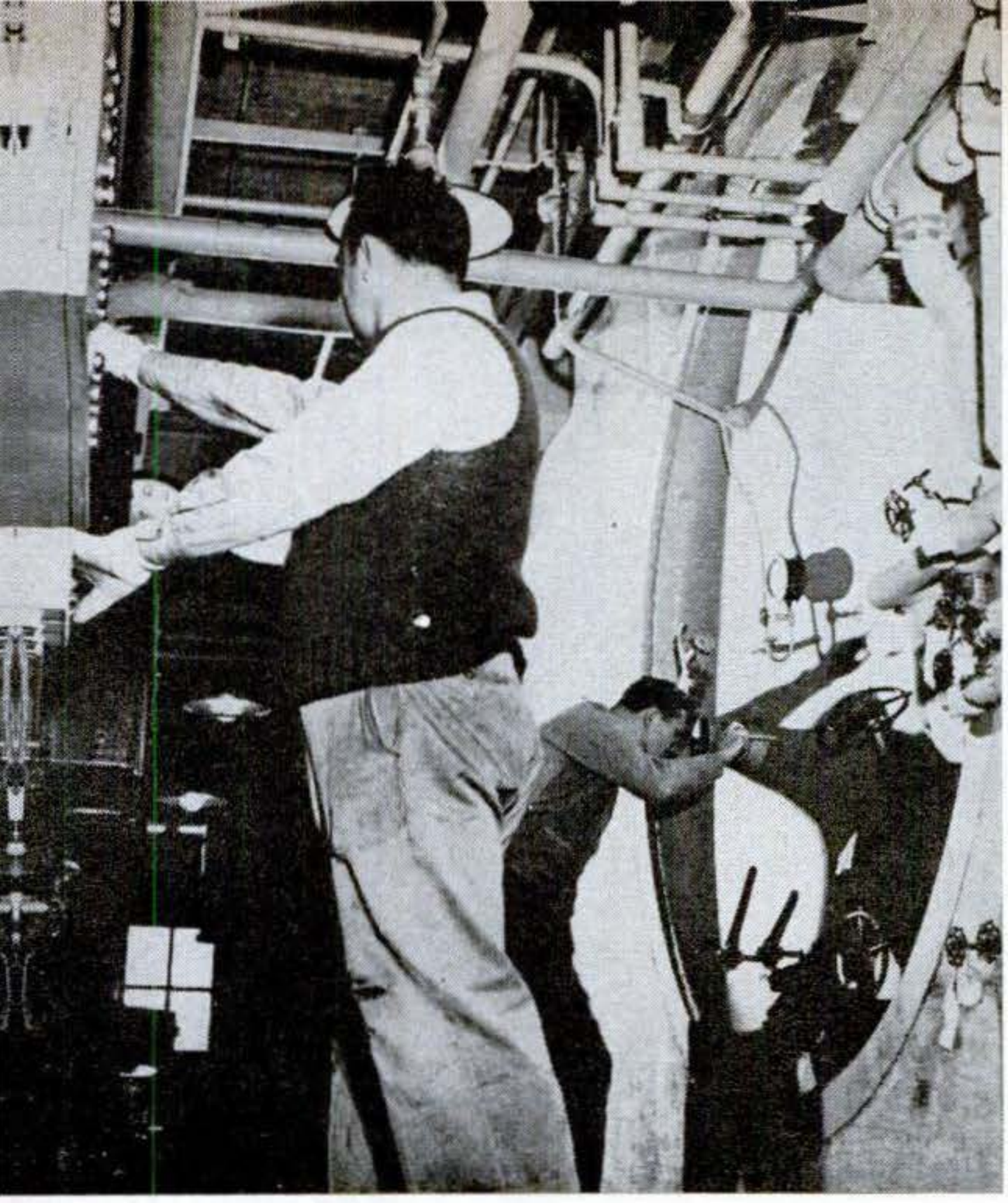
Giant's "Hat" Measures Light. When this mammoth "derby" swings down it forms a large spherical chamber with the inverted one below it. Called a photometer, the chamber is used to measure how much light is emitted by a lamp bulb placed inside. Here a Westinghouse engineer inserts a tiny radio-dial bulb for test.



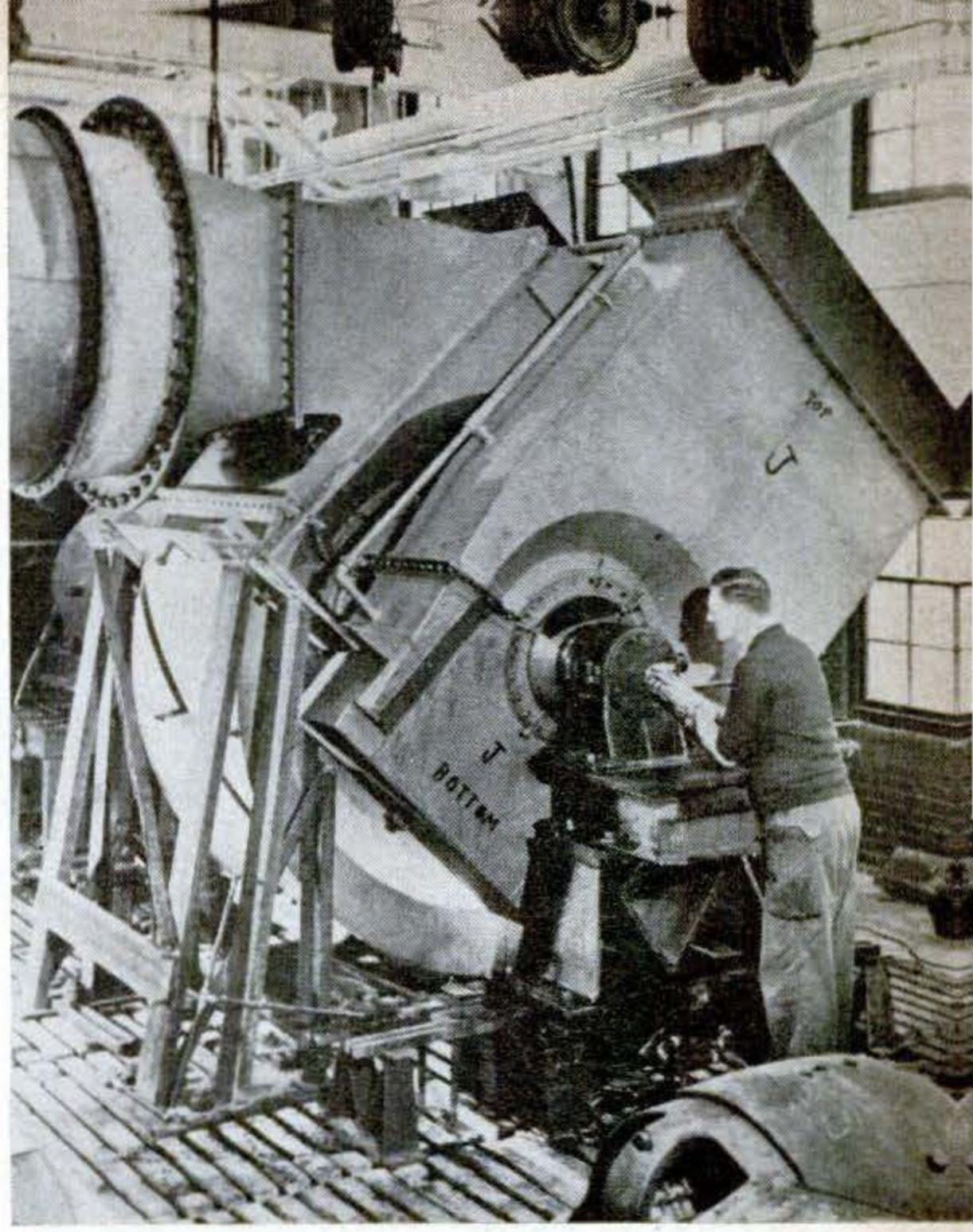
Inside Story of Wear. Why your wool coat wears out is shown in these pictures made by National Bureau of Standards scientists with the electron microscope. Originally a fiber of wool has a protective outer layer of strong interlocking scales (upper view). When this wears off, the soft inner structure (lower view) is exposed and soon disintegrates into a hole. The fibers were too thick to view directly, so pictures were made by using plastic impressions, "shadowed" with a thin chromium coating.

Alphabet Tube Spells Words. By projecting letters and numbers on its screen (right, below), this new Charactron® cathode-ray tube can spell out whole messages. Coded impulses guide the tube's beam to select and position the desired characters, which are cut out like stencils in a disk inside the tube. Inventor J. T. McNaney, Consolidated Vultee engineer, plans to use the tube in a receiver to translate incoming code into words, and then record them on film at up to 1,000,000 a minute.



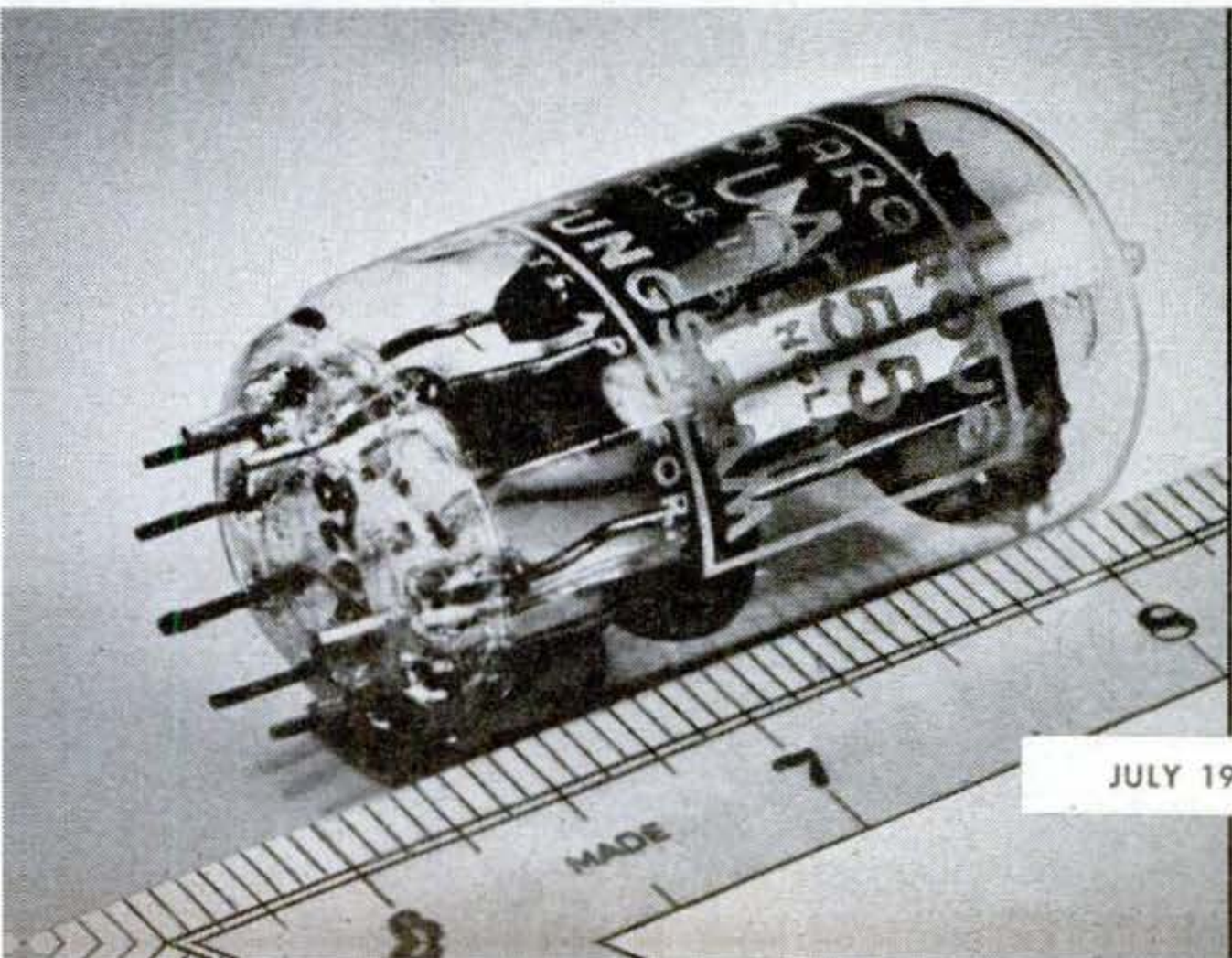


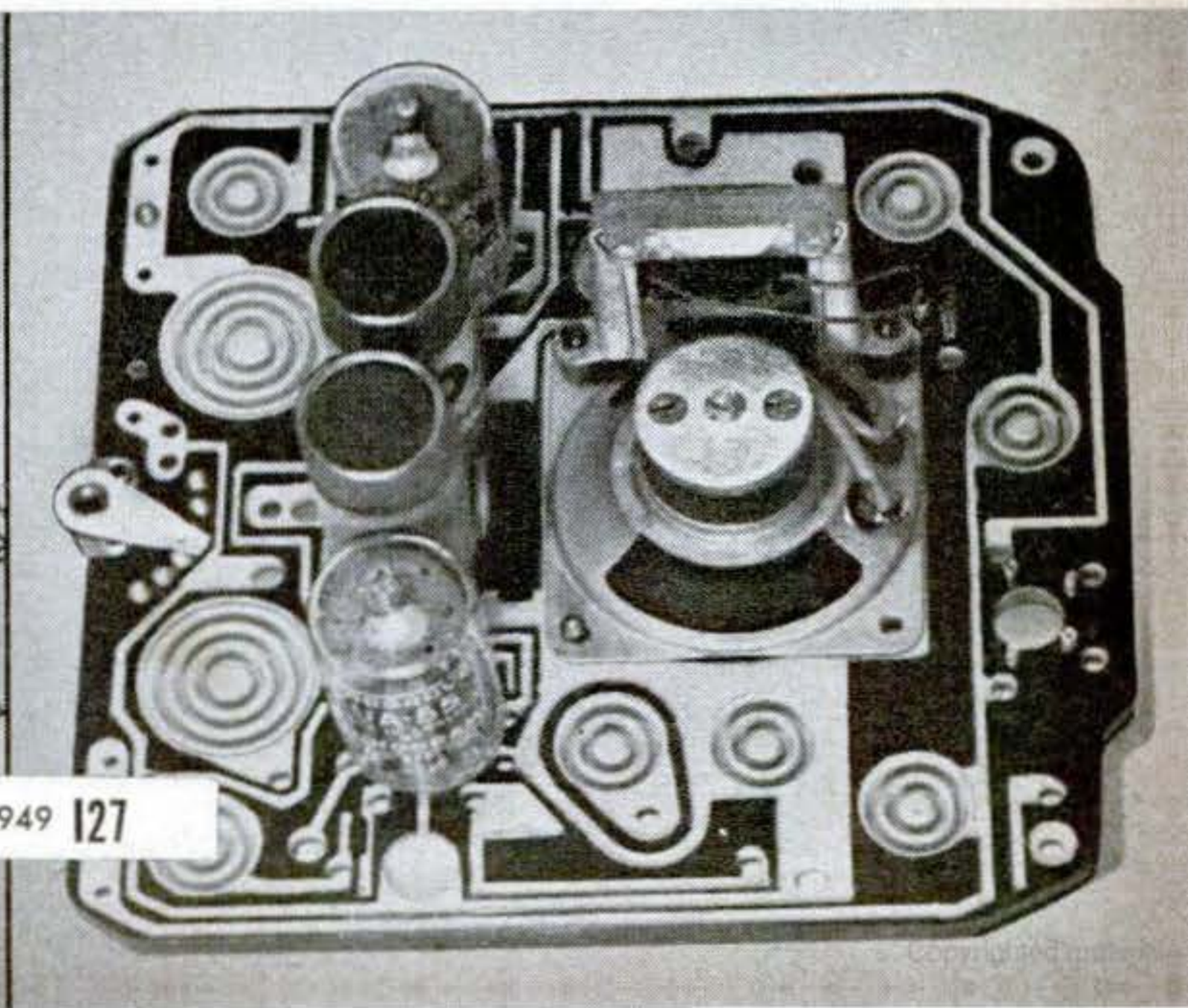
Taming Acetylene. Through a peephole in steel armor, an observer (background) watches a reaction in a new process that may produce synthetic chemicals for making rubber, textiles, dyes, and medicines. Its source is acetylene, under high heat and pressure. This is made possible by new safety techniques, including dilution of the acetylene with inert gas, to reduce explosion risk. Developed by German physicists, this method is being used for the first time in the U. S. by the General Aniline & Film Corp.

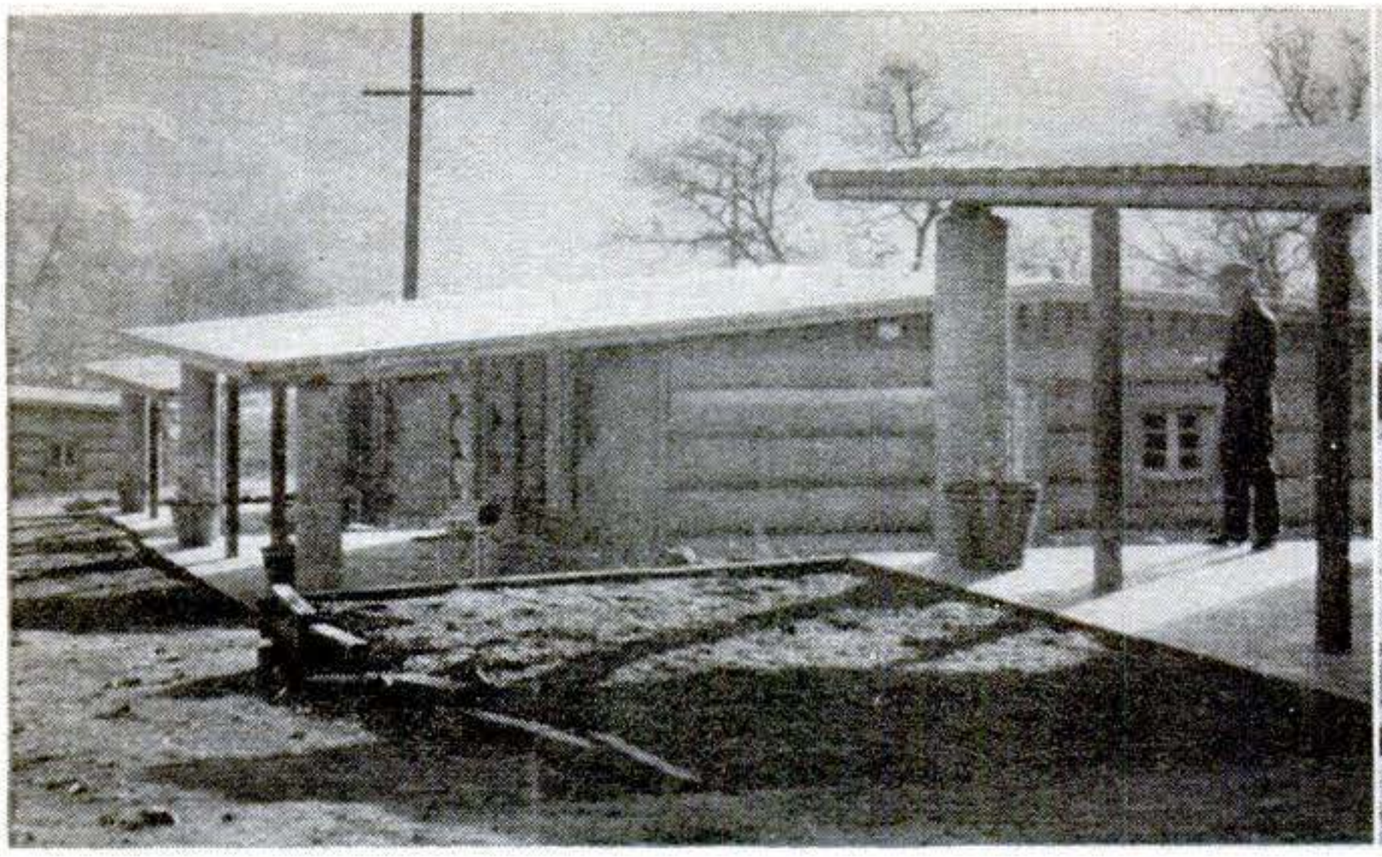


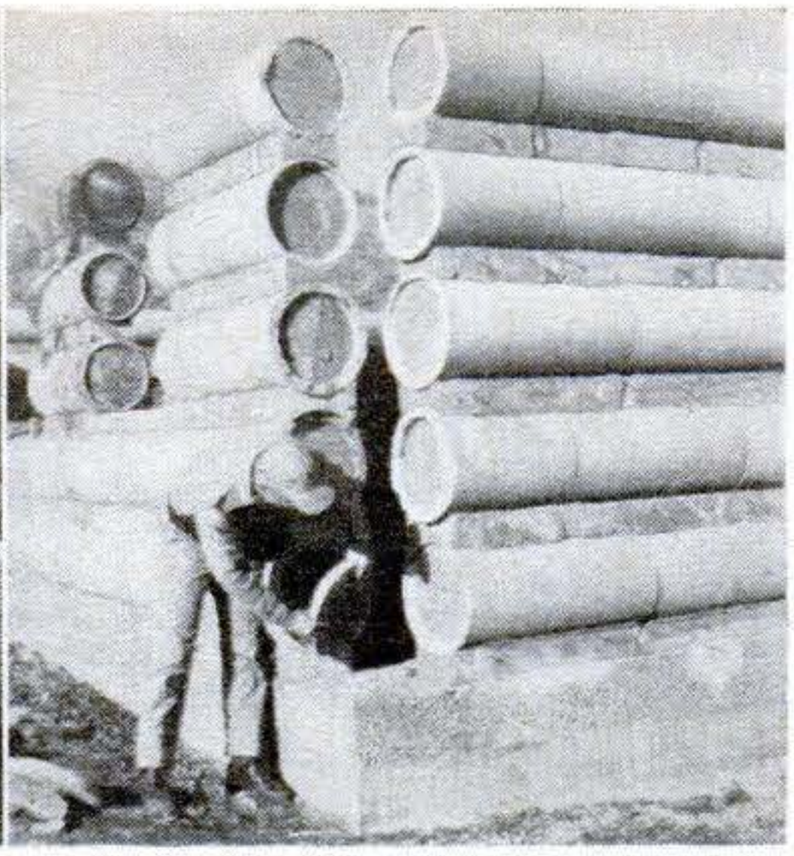
"Tornado" to Cool Pile. Twelve-foot-high blowers, like the one shown under test in the Westinghouse plant at Boston, will provide a tornado of air to cool the new atomic pile at Brookhaven National Laboratory, Upton, N. Y. Each 3½-foot-diameter fan is driven by a 1,500-hp. motor at a 450-m.p.h. rim speed, yet is said to be unusually quiet. Each one handles 80,000 cubic feet of heated air a minute. Brookhaven's reactor (PS, Apr. '49, p. 121) is the world's most powerful air-cooled pile.

Radio Tube Does All Jobs. This new Sargrove-Tungsgram UA-55® radio tube (left, below) can be made to do the job of any tube in a receiver from RF to audio output. Its split-grid design with a separate socket contact for each half-grid permits it to be connected in a variety of ways according to its function. This aids production and servicing of low-cost radio sets for users in remote areas. The tube's first use was in the mass-produced, printed-circuit receiver shown at right below (PS, Apr. '48, p. 160).



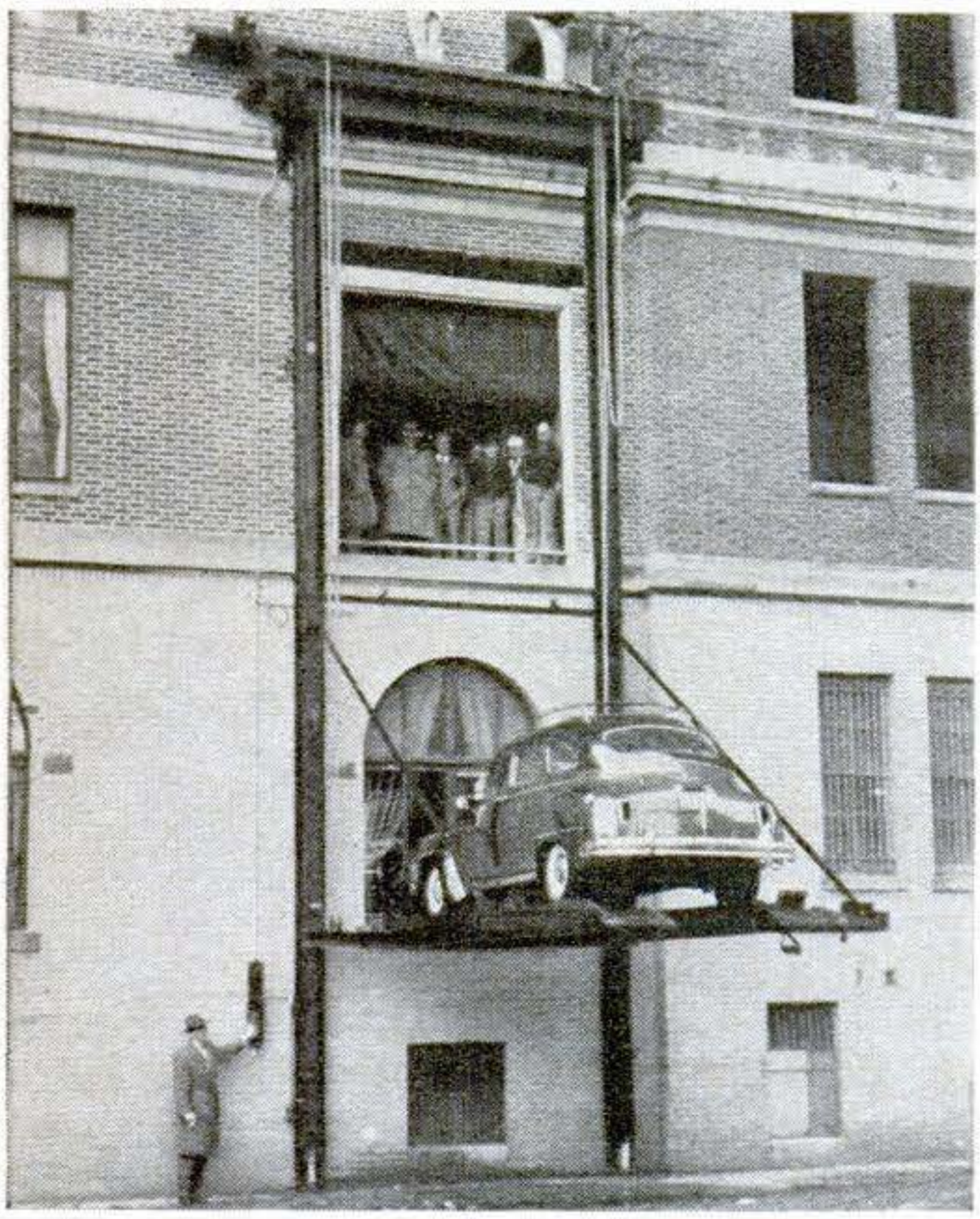






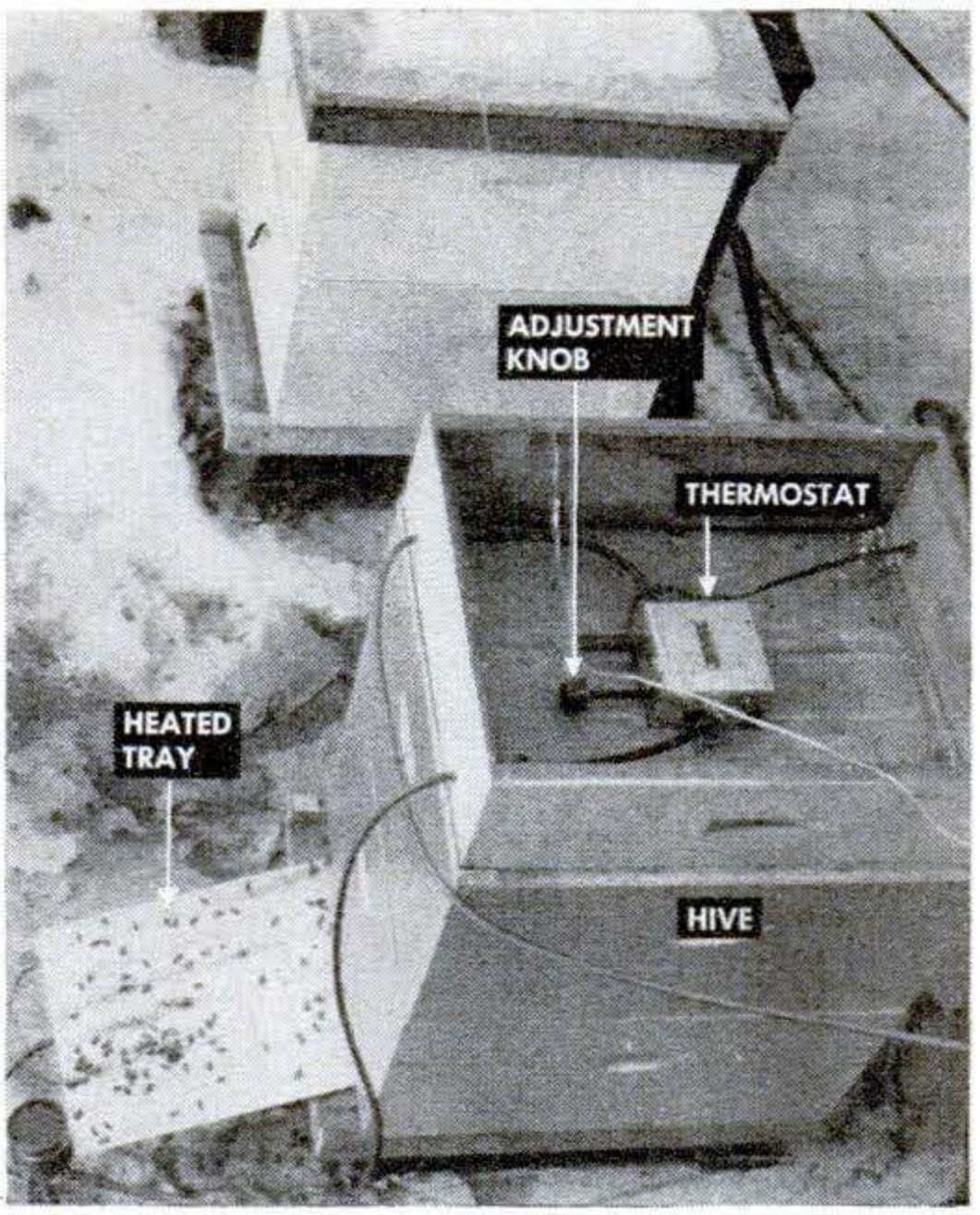
Concrete "Logs" Make Cabins

"Log" cabins for the dudes at one California ranch have walls that aren't wood at all. The "logs" are hollow concrete pipe, stacked on alternate layers of small, pre-cast saddle blocks. Concrete lids plug the pipe ends, as shown above at right. The cabins look like authentic Old West buildings, yet can be quickly built and are cool and fireproof. Those above are on John F. Van Leuven's River Way Ranch, at Three Rivers.



Elevator Climbs Wall

A NEW kind of elevator that rides outside a building permits heavy, bulky merchandise to be brought inside even when there are no ordinary freight-handling facilities. The Wall Climber Hoist® has a braced platform that rides up two rails set against the building wall. It can handle objects up to 18 by 10 by 9 ft. in size, weighing up to 7,000 lb. Photo shows it lifting a car into the Chalfonte-Haddon Hall Hotel, Atlantic City, N. J.



Electric Blankets Warm Bees

Now bees have electric "blankets" to keep them warm during cold northern winters. The "blankets" are aluminum trays, containing Nichrome® resistance wires, that fit inside the hives. The bees cluster over the units, keeping warm during cold weather when many bees normally die. One thermostat controls the "blankets" in 20 hives. The photo shows hives at U. S. Dept. of Agriculture Experiment Station, Madison, Wis.

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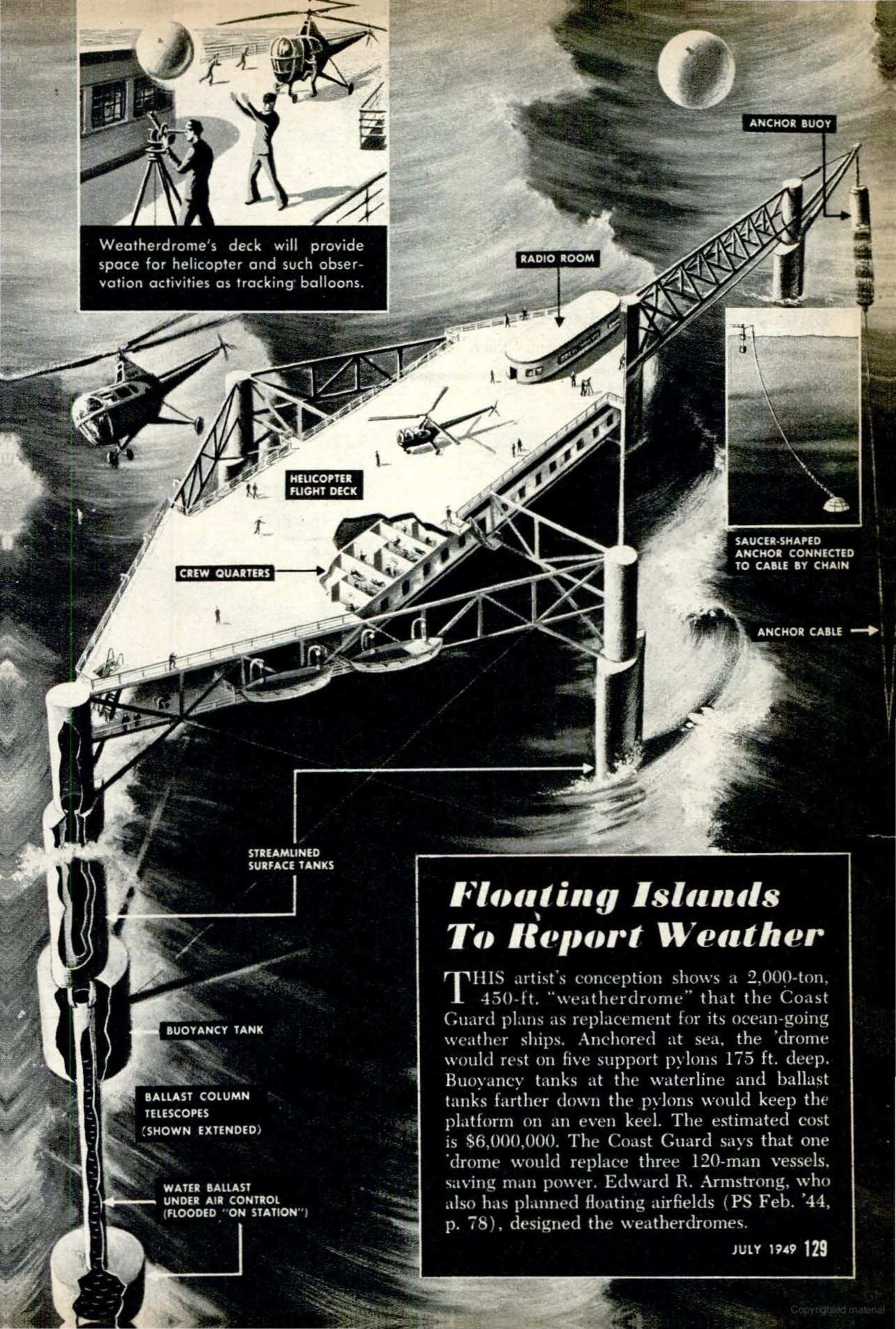
Weatherdrome's deck will provide space for helicopter and such observation activities as tracking balloons.



Floating Islands To Report Weather

THIS artist's conception shows a 2,000-ton, 450-ft. "weatherdrome" that the Coast Guard plans as replacement for its ocean-going weather ships. Anchored at sea, the 'drome would rest on five support pylons 175 ft. deep. Buoyancy tanks at the waterline and ballast tanks farther down the pylons would keep the platform on an even keel. The estimated cost is $6,000,000. The Coast Guard says that one 'drome would replace three 120-man vessels, saving man power. Edward R. Armstrong, who also has planned floating airfields (PS Feb. '44, p. 78), designed the weatherdromes.

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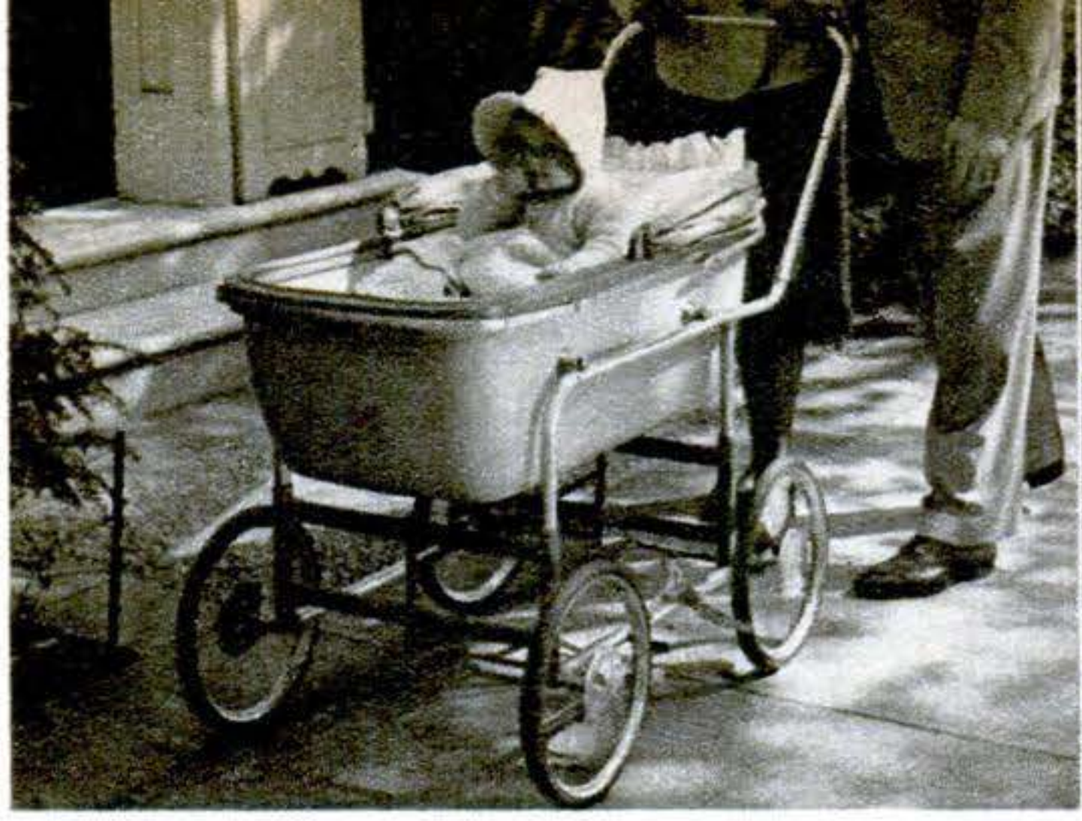


Baby Buggy Comes Apart

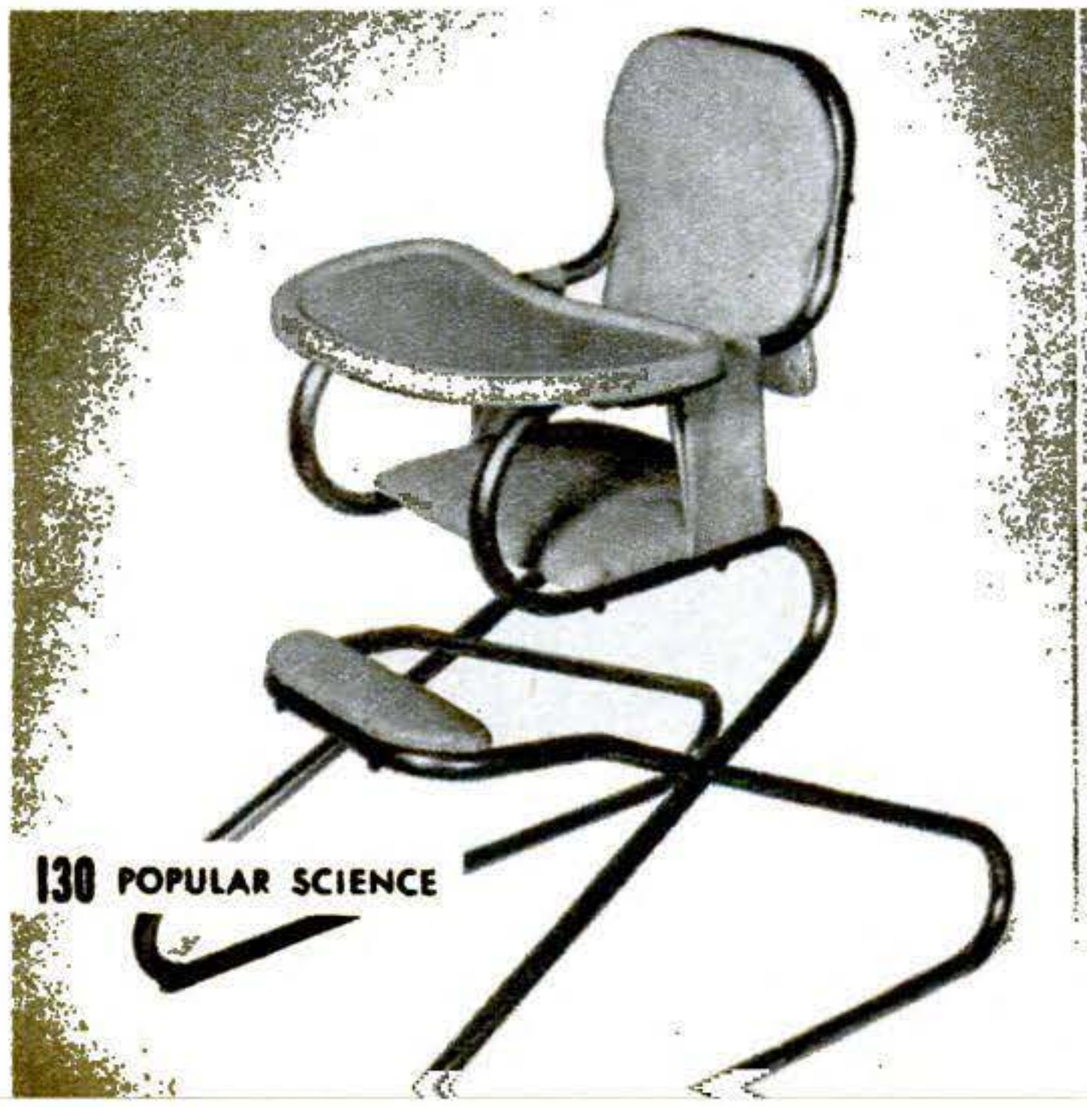
GETTING a baby carriage up and down stairs is easy with this one. It just comes apart, the upper part lifting off a foldable chassis (right above). The buggy's body, made of wood fibers bonded with Vinylite® resins, is said to be as strong as plywood. Carry-Cab Corp., of New York City, makes the carriage, which weighs less than 35 lb.

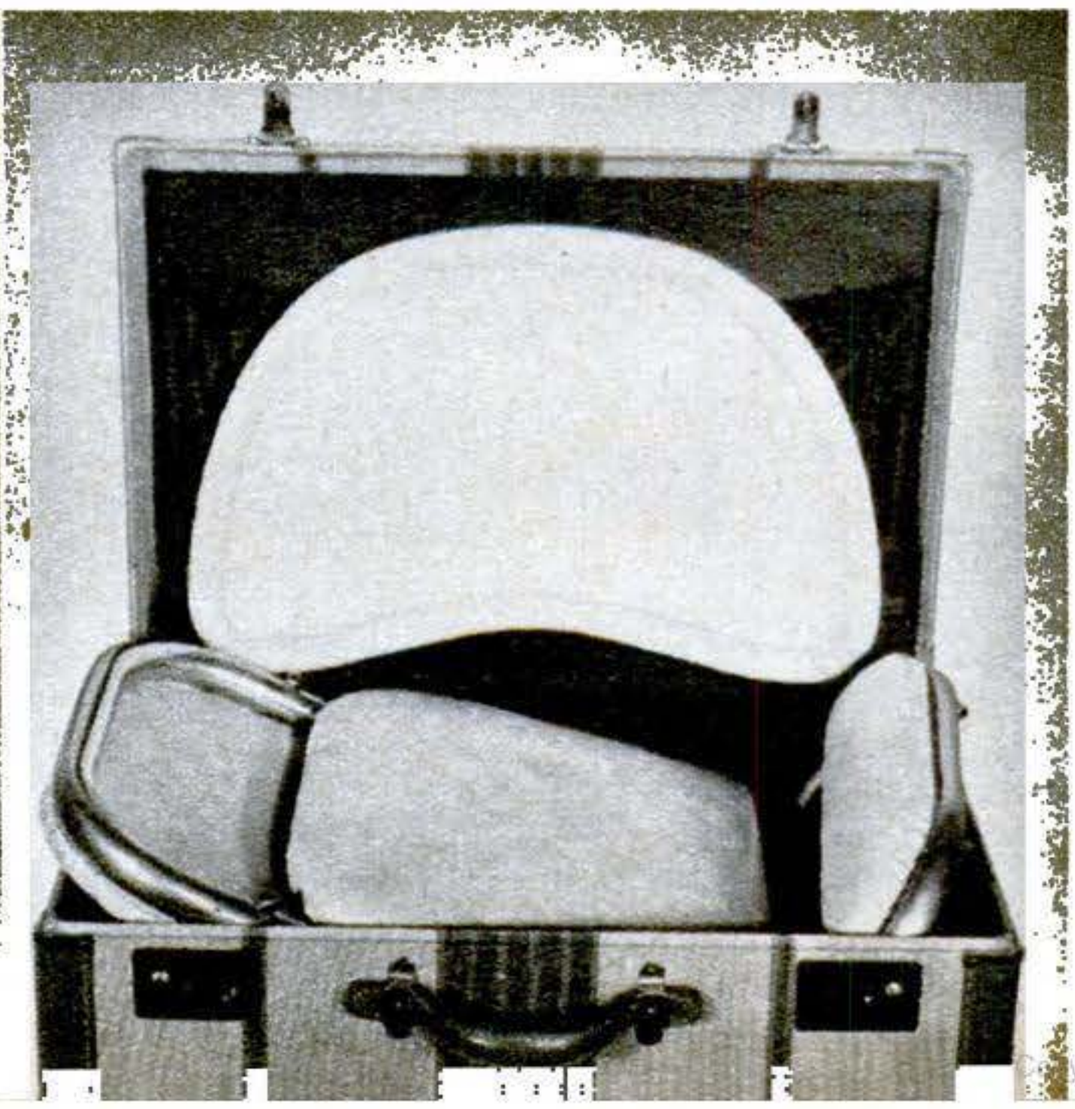
Playpen Doubles as Wading Pool

THIS 8½-lb., portable playpen, built of aluminum tubing and fish net, can be used as a pool. A damp-proof plastic bottom turns up at the edges to hold water. When the playpen is collapsed for carrying, its parts are rolled together and held by a strap, as shown at right above. Called the Playinet®, it is made by Dodge-Culp, Inc., of Little Neck, N. Y.

Highchair Goes on Vacation

JUNIOR'S highchair, below, collapses so you can take it on vacation. Made of aluminum tubing and washable plastic, the chair weighs only 10 pounds and is designed not to tip. When it is taken apart for traveling, everything but the tubing fits into a small suitcase, as shown at right below. It is made by WooDick Corp. of Madison, Wis.





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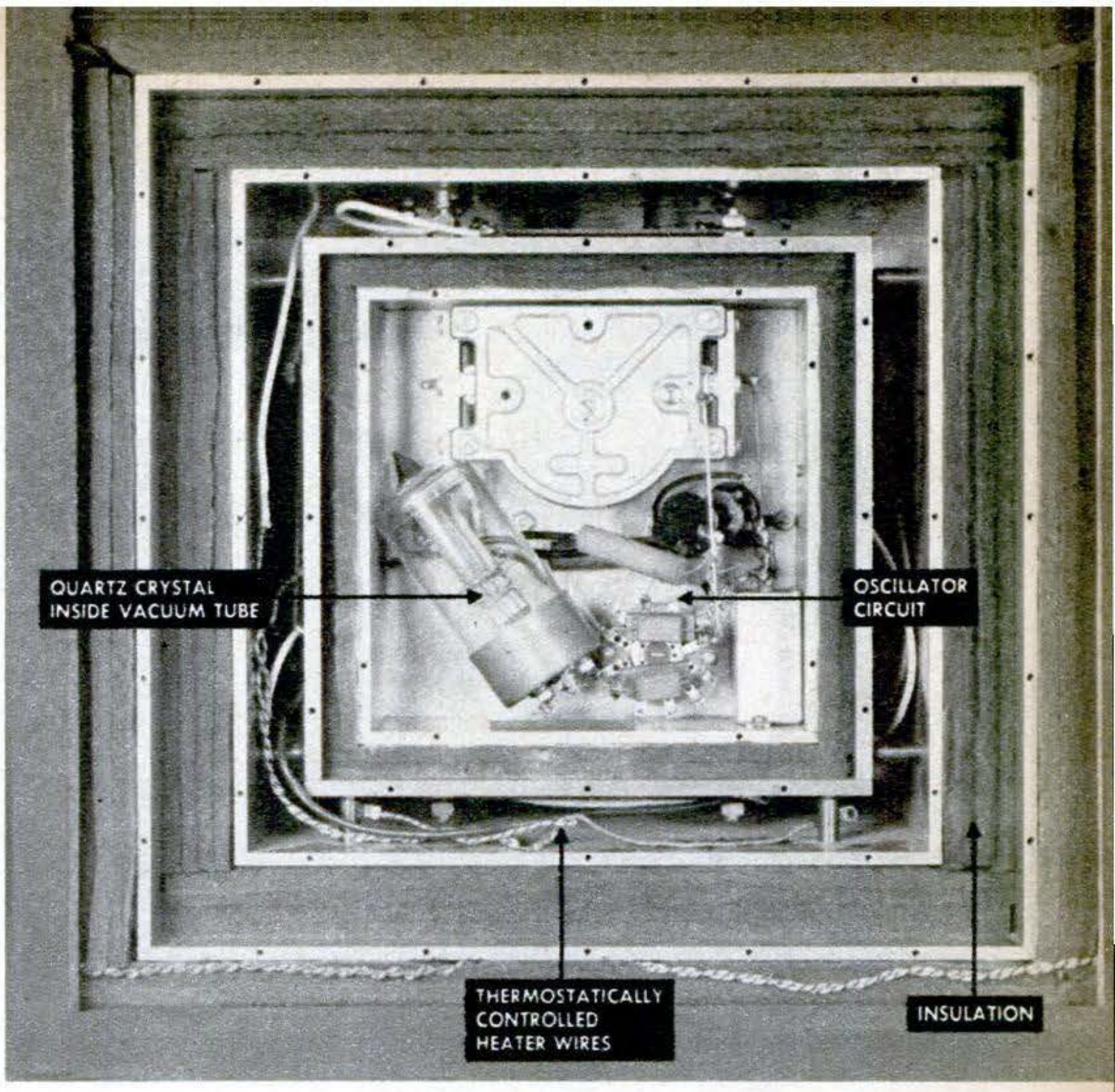
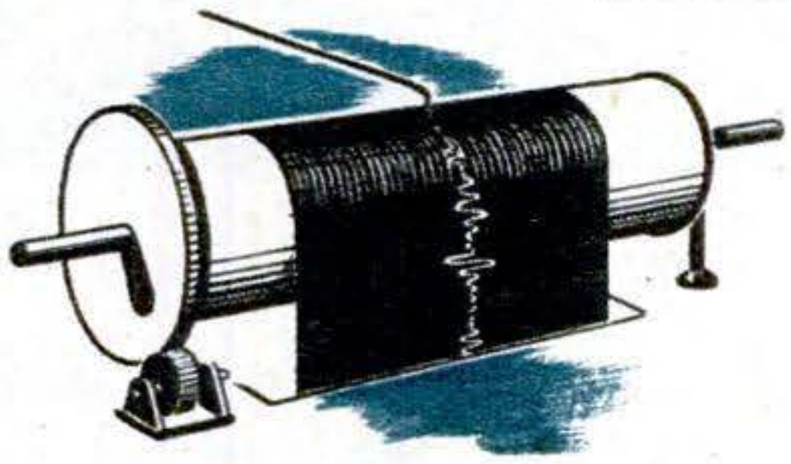
RADIO BROADCASTING

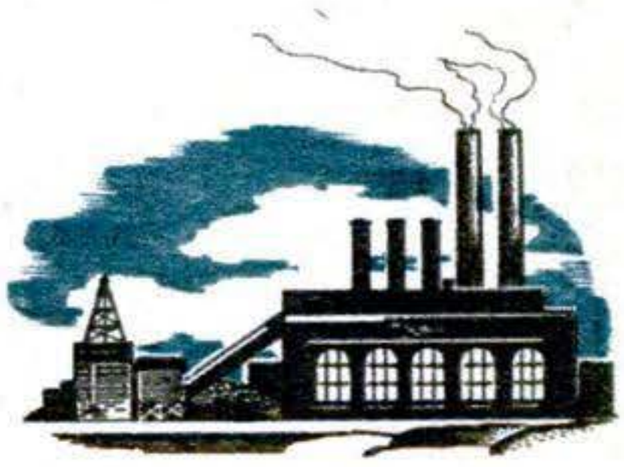
SURVEYING



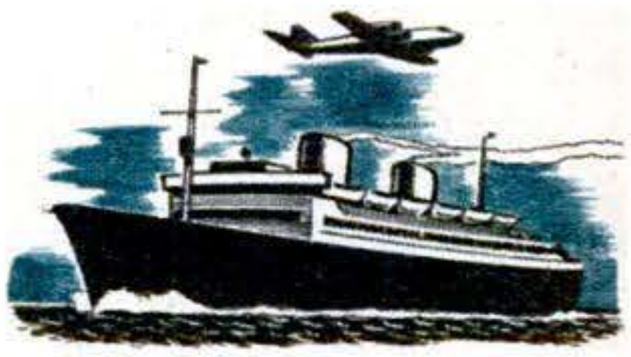
Insulated box guards one of the quartz crystals whose ticks are broadcast to variety of users. They help keep electric clocks on time, hold radio transmitters on the beam, and aid navigators and scientists.



EARTHQUAKE RESEARCH



POWER SYNCHRONIZATION



NAVIGATION

WWV's Sharp Tunes Keep World in Step

By Martin Mann

HIDDEN among the Maryland farms about 20 miles north of Washington, D. C., is a radio station that is on the air 24 hours a day—with some of the world's dullest-sounding programs. Listeners-in hear only whistles, clicks, and a few staccato Morse-code signals, interrupted periodically by a deep voice saying: "This is WWV, radio station of the National Bureau of Standards."

Yet, to a lot of people all over the world, these monotonous sounds are more interesting than Jack Benny—so interesting that the Bureau recently started another station, WWVH, in Hawaii. These odd sounds provide ultra-precise yardsticks for measuring frequency and time. They help hold radio

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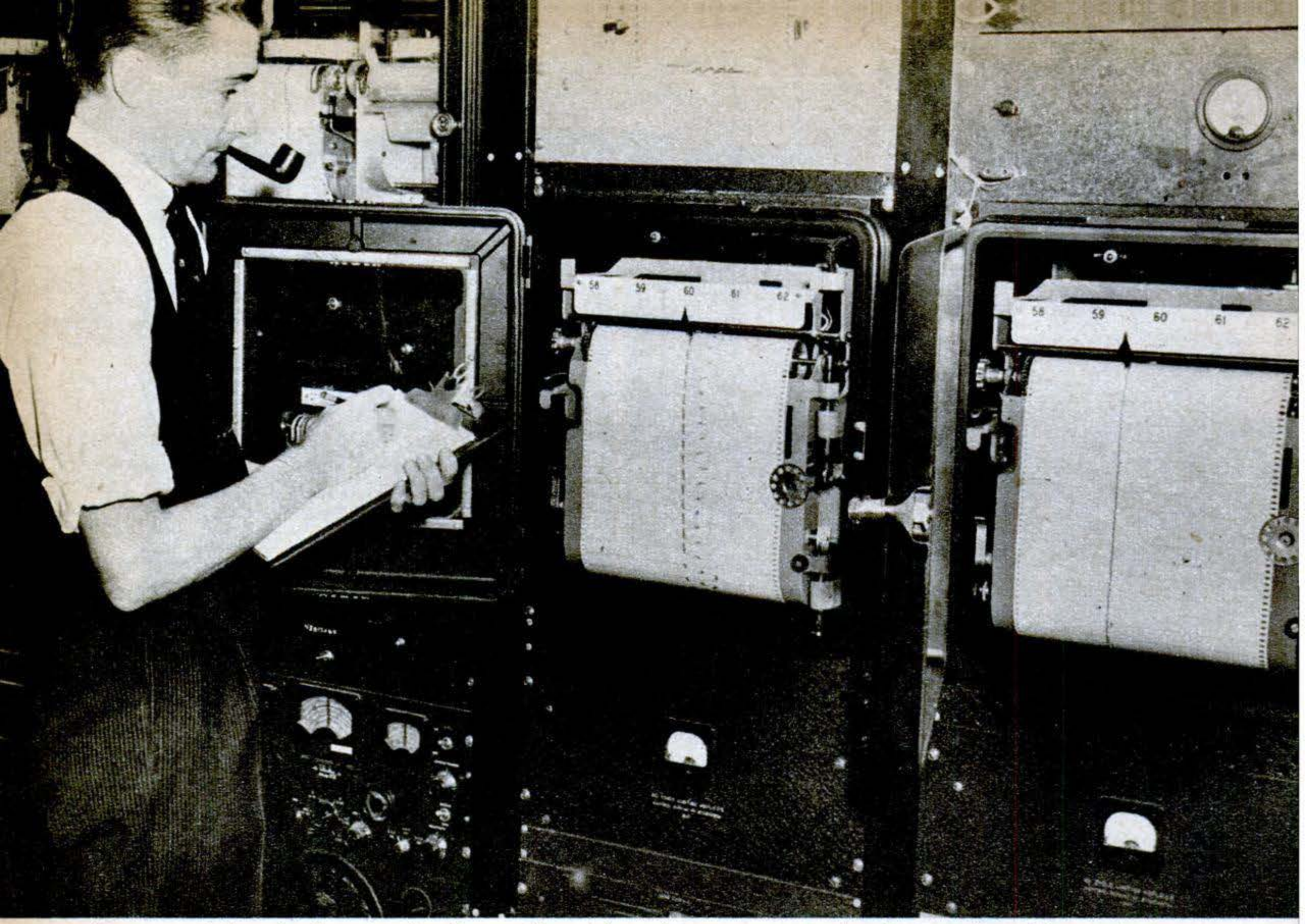

Bureau of Standards scientists keep tabs with automatic recorders on quartz crystal oscillators that set nation's frequencies. Pen wiggles indicate an error—here a few parts in a billion.

broadcasts on the beam, tell power companies how to adjust their generators so your electric clock keeps good time, aid the sending of photographs by wire and radio, tune musical instruments, and assist scientists and engineers studying earthquakes, running geological surveys, and making all kinds of measurements.

Radio engineers must keep their transmitters tuned to their assigned frequencies—the FCC permits variations of only 20 cycles, about .002 percent. They do this with a frequency meter, which is essentially an extremely accurate radio receiver. But how can they be sure the meter itself is calibrated correctly? They check it against the signals from WWV, which vary less than one part in 50,000,000, or .000002 percent.

Some musicians and most of the manufacturers of musical instruments no longer trust their ears to judge the standard note "A." For them, WWV continuously broadcasts the "A" note—a 440-cycle whistle. The companies that make radio sets use one or another of WWV's ultra-precise frequencies to test the instruments with which they adjust new radio and television receivers. And anybody who needs to know what time it is with equal accuracy—and a surprising number of people do—can listen to WWV's second ticks and the time announcement every five minutes in Morse code. The second ticks are actually beeps of 1,000-cycle whistles exactly one second apart and lasting 5/1,000 of a second.

It takes a lot of very fancy electronic equipment to keep the nation's time (frequency is simply another way of stating time). But the basic gadget that marks seconds and tiny fractions of a second so accurately is nothing but a piece of quartz, chemically the same as sand on a beach.

When quartz is vibrated mechanically, it generates electrical vibrations. Some phonograph pickups, for example, use quartz crystals to change the vibrations of the needle into electricity. WWV has three quartz crystals, shaped with a jeweler's precision to vibrate exactly 100,000 times a second.

The crystals are protected from drafts, dampness, and cold more cautiously than a week-old baby. First of all, they are mounted inside sealed vacuum tubes. Then each crys-

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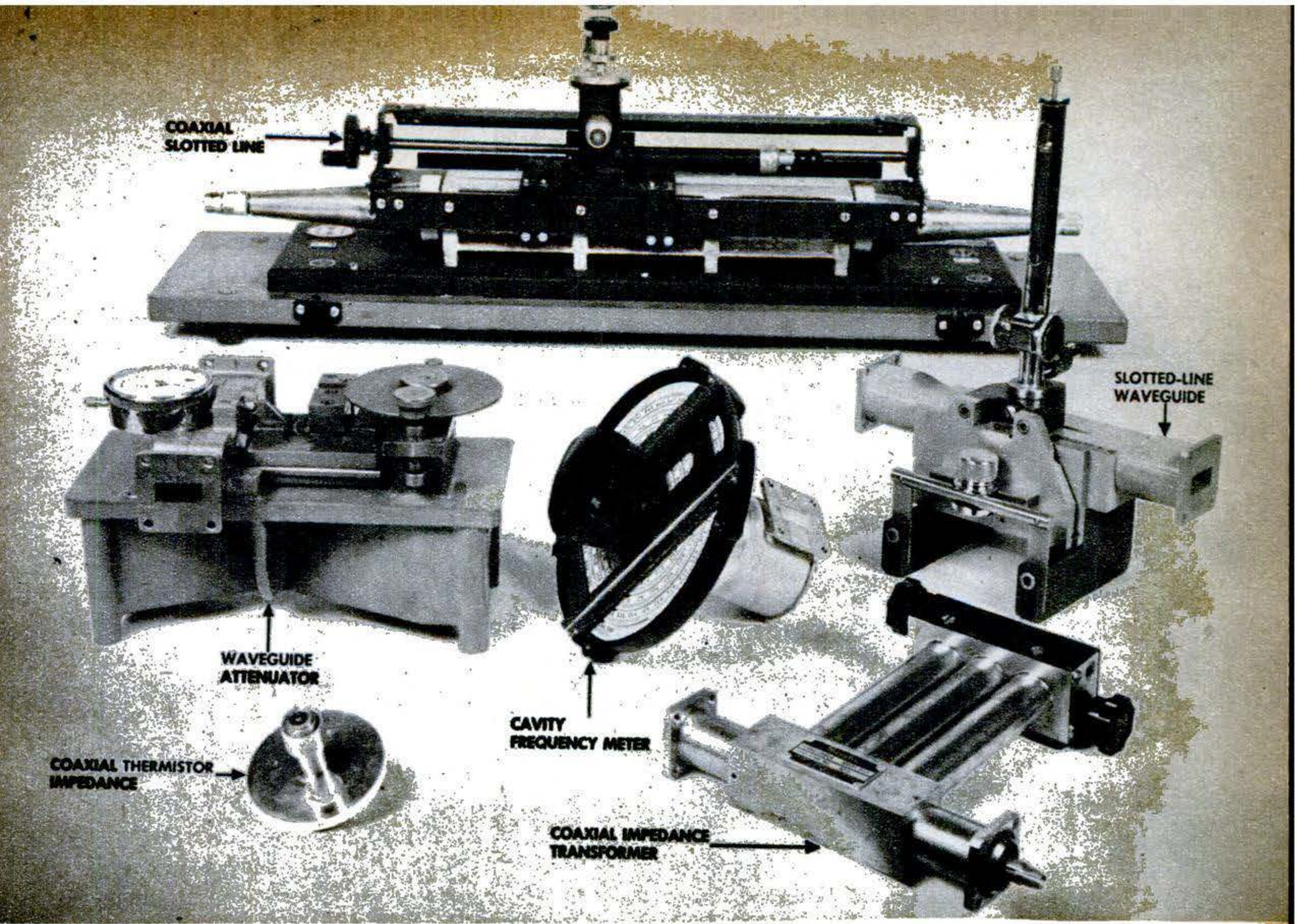

Instruments like these help measure power and frequency of microwaves. They are made with extreme mechanical precision, consisting mostly of accurately dimensioned pipes and cylinders.

tal tube is enclosed in a heavily insulated box that has a built-in electric heater and thermostat. And the boxes are kept in an air-conditioned, concrete vault 30 feet below the ground. The vault is locked—no one goes inside except in emergencies, for, despite these precautions, the crystals are so accurate that heat from a human body throws them off!

"Best" Crystal Runs the Show

All three crystals run continuously, but only the one that is "keeping the best time" is selected for broadcasting. This "best" 100,000-cycle wave operates everything at WWV. It is divided, with practically no loss in accuracy, into frequencies as low as 60 cycles, so that it can drive ordinary electric-clock motors used to switch the signals on and off. Other divisions provide the standard 440-cycle and 4,000-cycle whistles. It is multiplied, again with little loss in accuracy, to make the carrier frequencies on which WWV broadcasts. Five transmission frequencies, from 2,500,000 cycles to 35,000,000 cycles, are used to insure world-wide coverage.

Quartz crystals are the best standards of time and frequency we now have, but they do possess some disadvantages. They drift steadily. A good crystal clock may gain several seconds a year, even though its accuracy over 10-minute periods is better than one part in a billion. They operate at comparatively low frequencies, so that measurements up in the high microwave region can be made only by frequency multiplication, which involves much equipment and some loss in accuracy.

Good frequency standards are badly needed at the very high frequencies. The microwave relays that form inter-city television networks, for example, operate around 3 *billion* cycles. An error of .002 percent seems small, but at those frequencies it amounts to 60,000 cycles. You can fit six standard radio stations in 60,000 cycles! Thus, by reducing the amount of error, it might be possible to squeeze more stations into the overcrowded radio space.

In television, too, better frequency control may become vital if many networks adopt RCA's new system of synchronizing broadcasts from two stations using the same channel but in different cities. Extremely accurate

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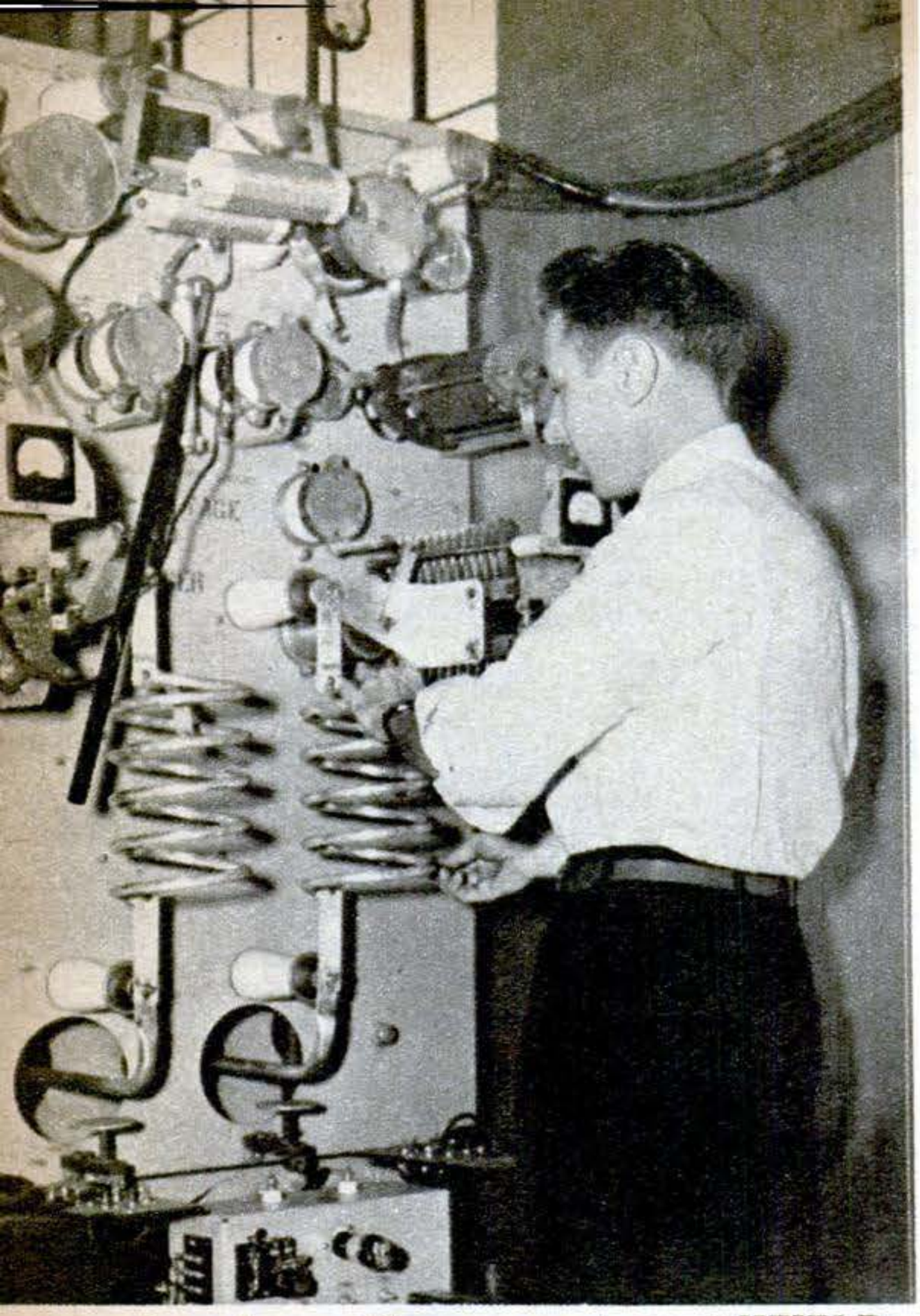

Interchangeable components permit WWV, Bureau's station, to broadcast on several frequencies. High-powered transmitter covers world night and day with WWV's time and frequency signals.

synchronization would permit use of the same channel by stations much closer together than is now possible. Without it, televiewers in between the two stations would see "venetian-blind" interference on their screens.

The very high frequencies are finding many other applications, too. Radar works up there, for example. So do the new navigation systems, weather-reporting networks, blind-bombing techniques, control systems for guided missiles, atom smashers, industrial heating devices, and some medical instruments.

One of the new uses of very high frequencies is microwave spectroscopy—the study of the way atoms and molecules absorb microwave radio beams. From this study are coming promising methods of controlling frequency and telling time.

All atoms and molecules can be made to change their internal arrangements if fed energy of the correct frequency. They will soak up energy of just that frequency and no other. This means they can be used as standards of frequency or time. They are more accurate than quartz crystals and would never drift. They would even be more accurate than the present ultimate standard of time, the rotation of the earth – which is slowing down enough to make a difference of around half a minute every century, besides changing for no good reason every once in a while.

For some substances, like ammonia, one of these absorption frequencies occurs in the microwave range. The Bureau of Standards has already made a combination frequency standard and clock that is controlled by the microwave absorption of ammonia (PS, Mar. '49, p. 143). It has a quartz crystal and frequency multipliers to generate the 24-billion-cycle signal absorbed by ammonia. The signal is fed into a tube containing ammonia, which will absorb most of it as long as it is at exactly the right frequency, creating a dip in the output from the other end of the ammonia container. Variations in the dip automatically adjust the crystal to bring it back to the right frequency.

But the ammonia clock still requires clumsy and expensive equipment—quartz crystals, frequency multipliers, and servo-mechanisms. Dr. Harold Lyons, who built the first model, is now trying to eliminate these by working down from the high atomic frequencies instead of up from the low crystal frequencies.

"Magic-Tee" Controls Atom Clock

One possible method will use a "magic tee," a T-shaped arrangement of square copper pipes (waveguides). The magic tee acts as an electric gate. When the electrical loads on the two arms are balanced, no current (very, very high frequency current, that is) gets through the straight part. But when the loads are unbalanced, current will flow. In Dr. Lyons' proposed setup, the load on one arm will be a cell filled with ammonia gas, which will balance the load on the other arm so long as it does not absorb any current. The ammonia will absorb current only at its 24-billion-cycle absorption frequency, so the loads can be unbalanced only at this frequency, and only current of this frequency can get through the magic-tee gate. This precisely regulated frequency can then be divided into any desired value. The chief difficulty here is building the 24-billion-cycle amplifier needed to go with the device.

An ammonia clock should be accurate to about one part in 100,000,000—twice as good as a quartz-crystal clock. It might be even more accurate except for a characteristic of

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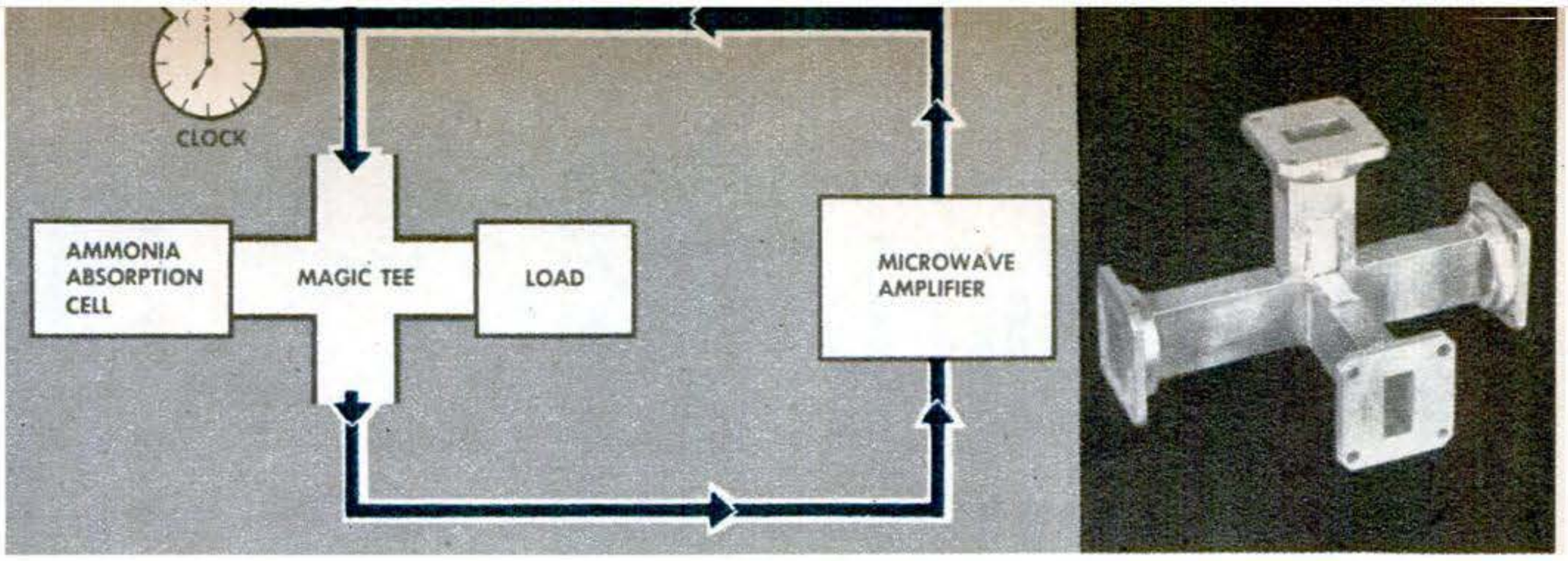


Quartz crystals may lose their jobs as nation's timekeepers to more reliable ammonia molecules. One proposed ammonia clock (above) uses a microwave "feedback" oscillator controlled by "magic tee," a T-shaped connection of square pipes (at right above). This acts as electric gate, with ammonia as gatekeeper, permitting only correct frequency to get to amplifier and clock.

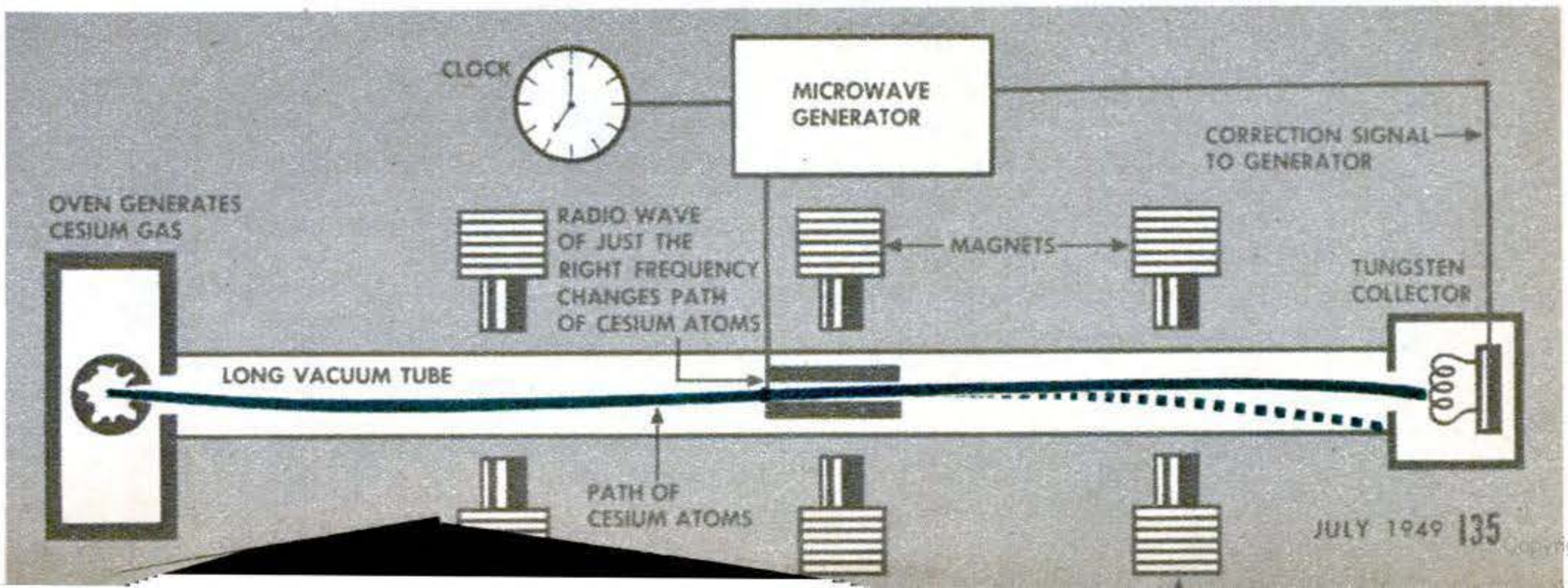
all atoms and molecules. We have been telling you that atoms and molecules absorb radio waves of *exactly one* frequency. Actually, however, this is not quite true. They really absorb waves over narrow ranges of frequencies, which thus limits their accuracy. The width of these ranges depends on the particular atom or molecule, the speed at which it moves, and how much it is bounced around by bumps against the walls of the container and other atoms or molecules.

In the search for still higher accuracy, a somewhat different atomic clock is being designed for the Bureau by Prof. Polykarp Kusch, of Columbia University's atomic-beam laboratory. Dr. Kusch's clock will use atoms of cesium, a soft, silvery metal used in photoelectric cells. They will travel down a long vacuum tube, past several magnets, to a hot tungsten collector wire. The magnets will be arranged to make the cesium atoms move in a curved path that ordinarily misses the collector wire. However, when radio waves of just the right frequency (about 10 billion cycles) are applied to the cesium atoms near the center of their path, the internal magnetism of the atoms will be altered, changing their path so that they *do* hit the collector wire. Almost as soon as the cesium atoms strike the hot tungsten, they boil off, but leave behind their electrons. The electrons added to the collector make a signal current that is amplified to control the 10-billion-cycle radio-wave generator, the signal appearing only as long as the generator is at the right frequency. The signal's absence automatically corrects the generator.

The beam clock, still in the planning stage, is expected to be accurate to about one part in 10 billion. It will be much better than the ammonia clock, mainly because its thin stream of cesium atoms will not suffer as much from collisions. One difficulty, however, will be getting rid of the cesium metal that will build up on parts of the apparatus, eventually clogging the narrow slits that keep the beam sharp.

These new devices—and others that are still vague ideas in the brains of Bureau of Standards physicists—will make time and frequency measurements more fantastically precise than ever before. They will make WWV's broadcasts more interesting to scientists, engineers, and military men. But to anybody else, the whistles, clicks, and code signals will still sound as dull as ever. END

Still more accurate clock would send atoms of cesium down long tube between magnets. Microwaves of right frequency change internal magnetism of atoms, making their path through magnetic field shift to take them to collector wire. Atoms hitting collector create signal that holds generator on right frequency. Potential accuracy of the atom clock is one-second error in 300 years.



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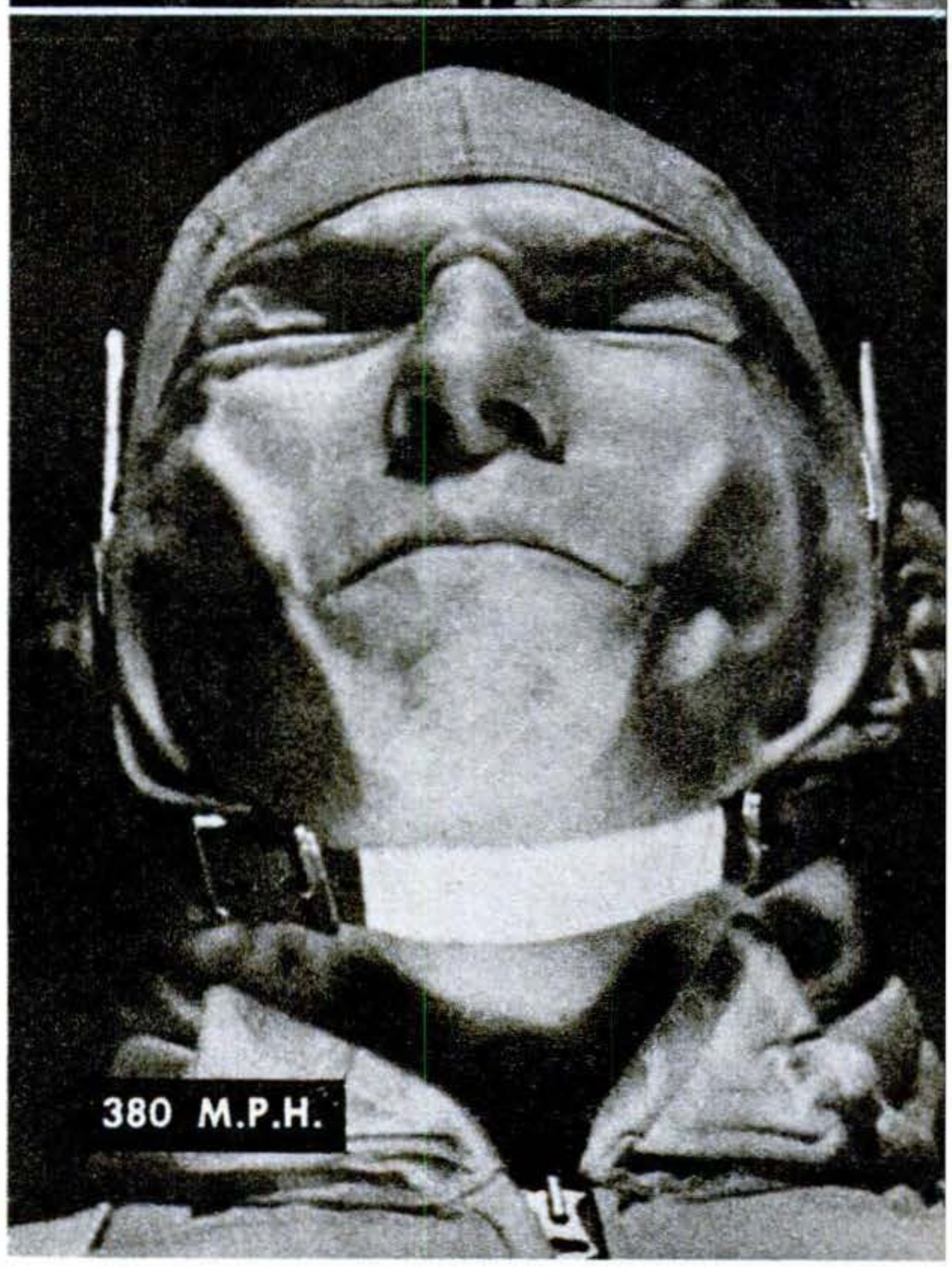
How Much Wind Can You Stand?



THE Navy's doctors know now what happens to a man when he bails out of an airplane going almost 460 m.p.h. And contrary to some German reports, based on wartime research, they find that while he can take it, it sure pushes him out of shape.

Two enlisted men volunteered for tests in an eight-foot wind tunnel at the Naval Medical Research Center, Langley Field, Va. Its 36-blade, 16,000-hp. fan blew dust-free air at them for one or two seconds at a time at speeds up to 458 m.p.h. As shown at right, cameras recorded what happened.

At as little as 131 m.p.h. the skin tissue over the cheeks and neck began to ripple. The wind flattened wrinkles, pushed the nose to one side, and spread back the loose skin on the neck. At 195 m.p.h. the heavily padded flight helmet worn was found to have too much wind resistance, and a tighter, cloth helmet was substituted.

As velocities got above 400 m.p.h. the men had to tilt their heads slightly forward to keep their eyes closed—the wind tended to blow them open. The doctors estimated that at 458 m.p.h. the "local velocities"—the speed of the wind over the curved areas of the face—might have been as high as 728 m.p.h., only slightly less than the speed of sound. The men complained of no particular discomfort, but without the lab's elaborate safety precautions things might have been a lot different.

As a result of the test, Navy pilots and aircrewmen will probably wear face hoods for protection in bailouts at high speeds.

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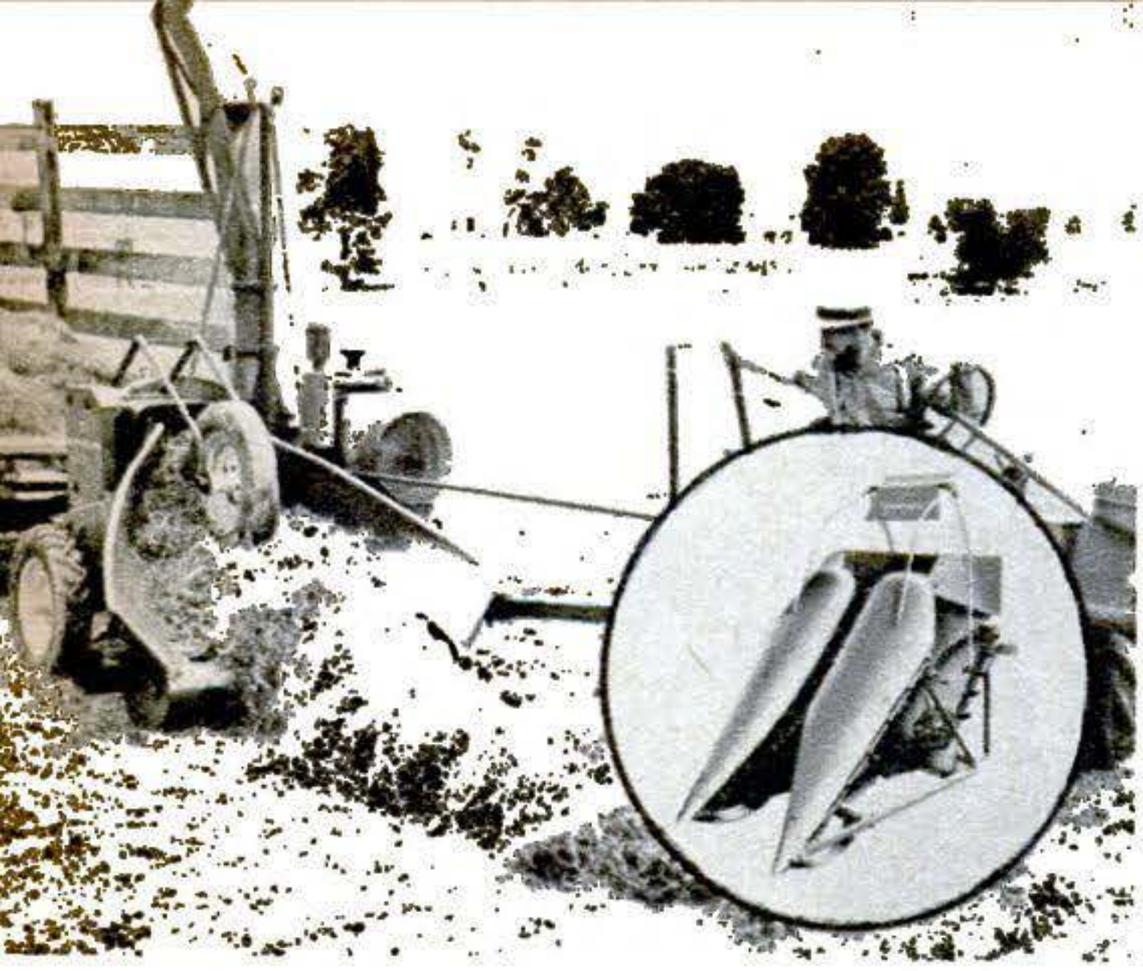
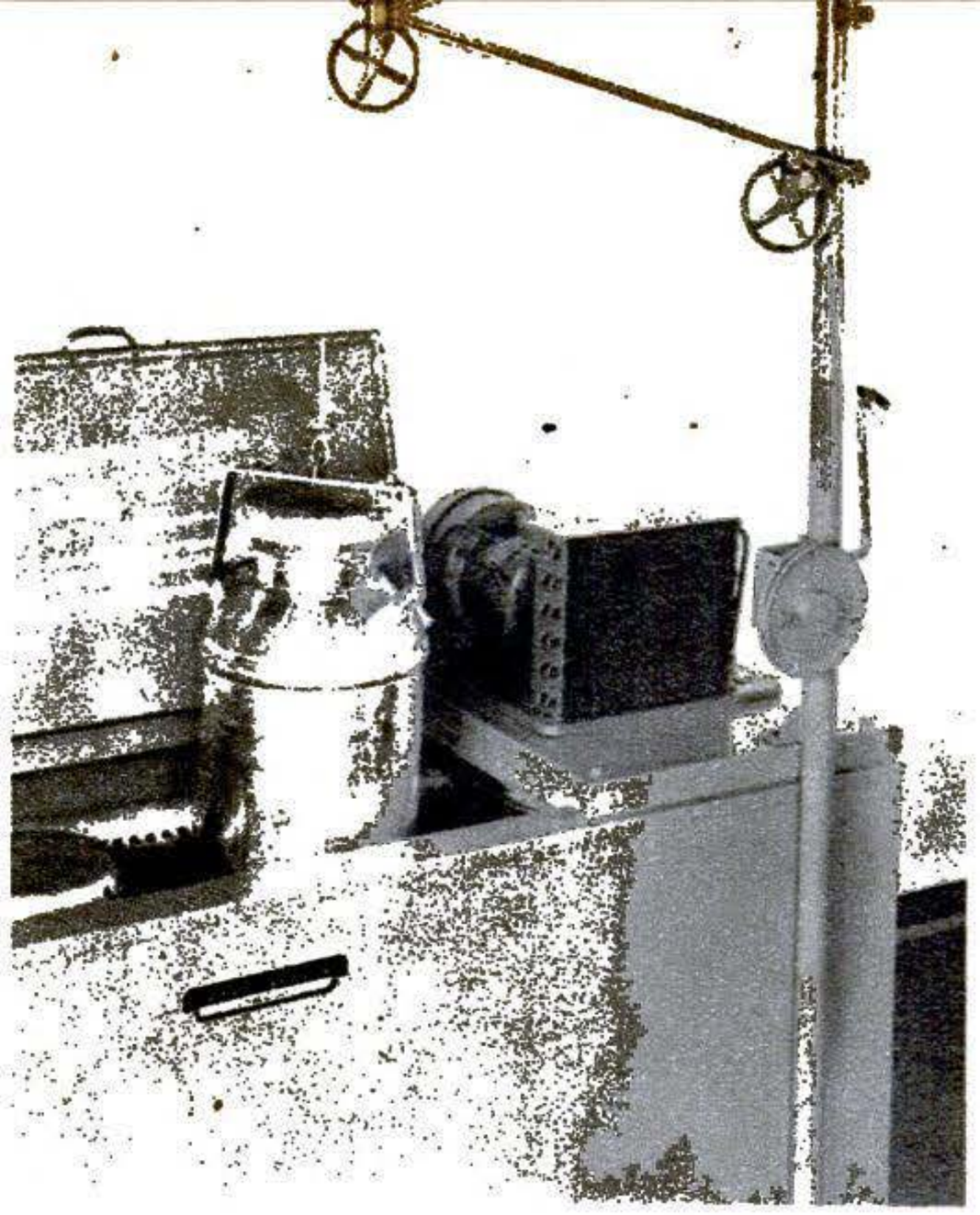


Harvester Chops Silage

QUICK change-over from windrow to row-crop working is easy on this new automatic field harvester. An attachment for either operation can be teamed up with the basic unit in about 15 minutes. If necessary, they can be swapped right in the field in a half-hour.

Pictured above is the combination that automatically picks up hay from the windrow, chops it, and blows it into a trailing truck for removal to silo. Shown in inset is the corn-harvesting unit, which sweeps along a row, cutting and chopping corn for silage. A device that shakes out dirt and stones is also available for use with the windrow pick-up. The equipment is made by New Holland Machine Co., of New Holland, Pa.



Hoist Saves Lifting Milk

A CHILD can lift full milk cans into or out of a 2½-ft.-high electric cooler with this new hoist. Farmers, who lift more than a ton a day if their production reaches 10 cans of milk, now need only fasten a clamp around the neck of the can and turn a self-locking crank. The new hoist is non-electric and uses a stranded steel cable. Developed by Westinghouse as an attachment for a milk cooler, it retails for about $32.95.

Trailer Totes Whole House

THIS tractor-trailer packs a whole house. Its 80 compartments are loaded at the end of the factory assembly line with 3,300 parts and 4,000 nuts and bolts – including all plumbing and fixtures – needed to erect a porcelain-enameled Lustron Home®. At the home-owner's location, the trailer with its 46,000-lb. load serves as a complete home-construction storehouse. White Motor Co., of Cleveland, makes the trucks.

Portable Filter Purifies Water

GRAVITY does all the work in this double-deck water filter. So simple and easy to carry that it can be set up anywhere, it lets water drip from the top container to the lower one. All sediment, off-color chlorine taste, and other impurities are taken up by two stainless-steel screens and a carbon pad, which contains an element eliminating bacteria in the pad itself. Sparkler Mfg. Co., Mundelein, Ill., makes it.

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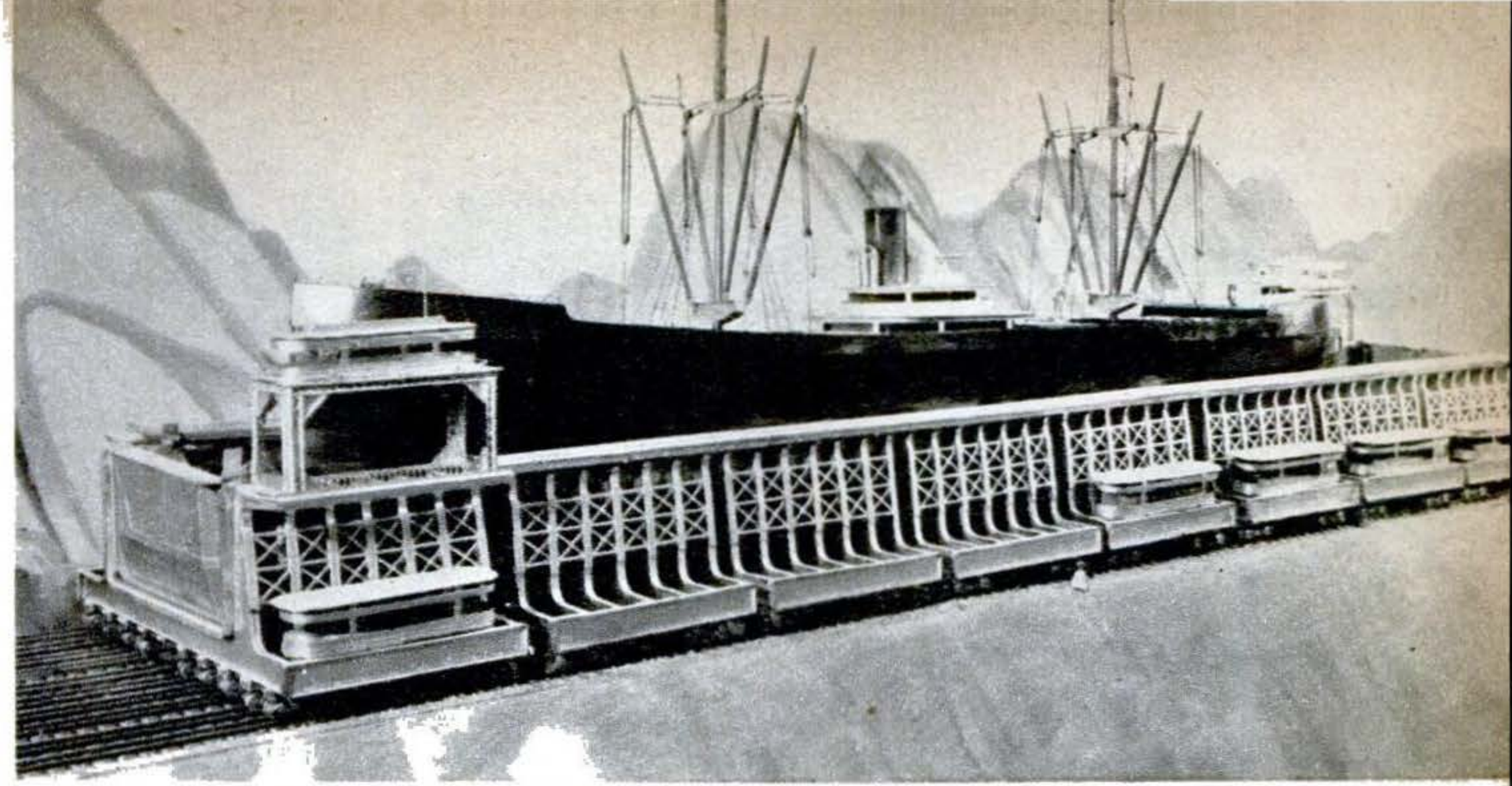


Model shows cradle carrying 15,000-ton ship on ten tracks across the Isthmus of Tehuantepec.

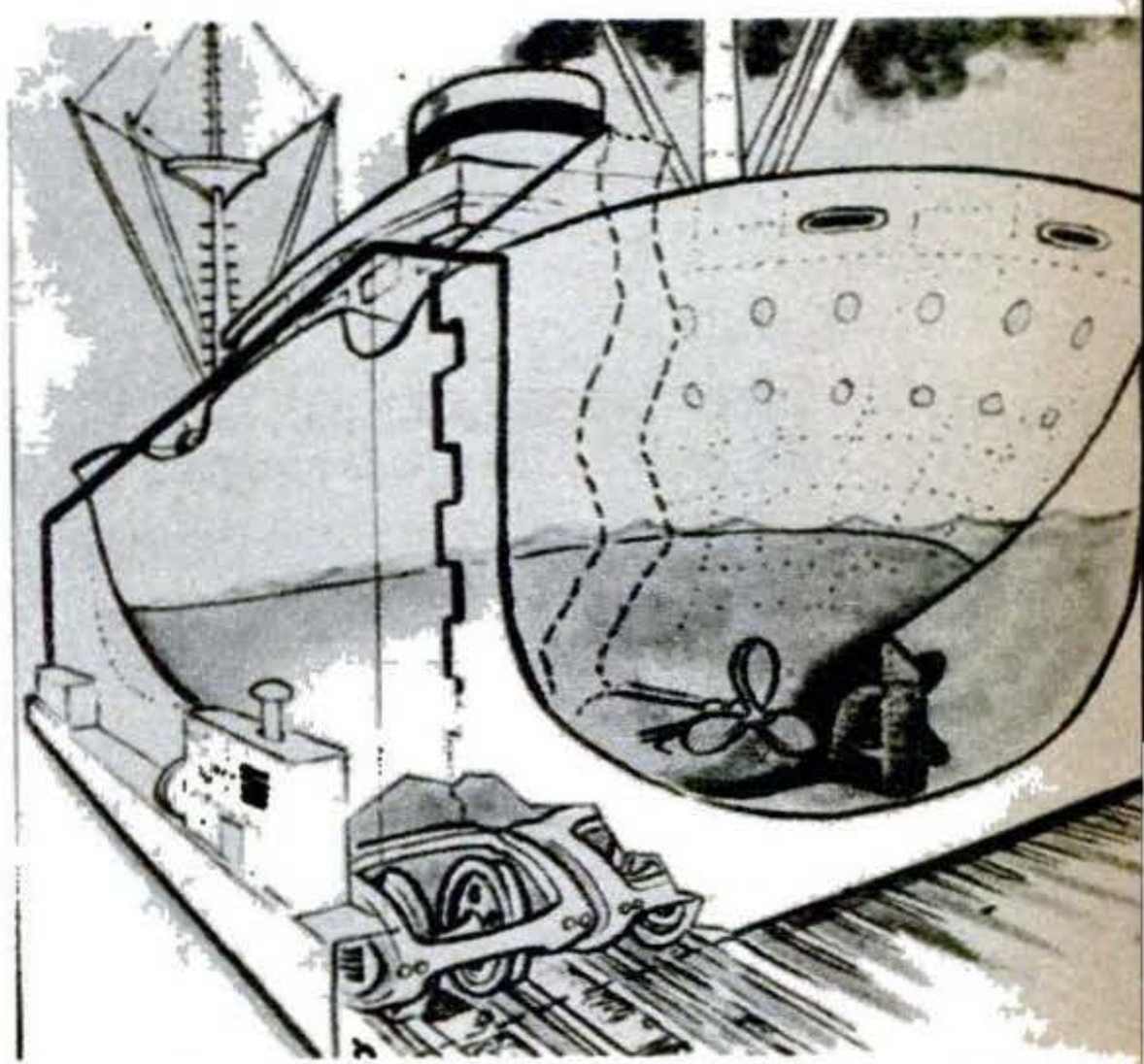
Bathtub Trains May Haul Ships

BIG ships may someday be carried bodily across the mountains of Mexico. This ambitious plan is being urged as the best way to end Panama Canal traffic jams.

The ships would be hauled across the Isthmus of Tehuantepec, route of the '49ers, floating in water-filled cradles like huge toys in bathtubs. These "bathtubs" would be supported by railroad trucks rolling on ten pairs of tracks, laid side by side. Built-in locomotive units would power the cradle.

At the two ocean terminals, the tracks would run down grade into the water, like the tracks used to haul out yachts. The empty cradle would be run down and filled with water, and the ship would enter the cradle just like a drydock. The gates would then be closed, and the cradle, now carrying the floating ship, would roll up onto dry land.

The route of the ship railway would roughly parallel the 188-mile railroad that now crosses the isthmus. Backers of the plan declare it less expensive than a doubled Panama Canal or a new canal over another route. It should also be less vulnerable to air bombing. Such a line has been proposed in France between the Atlantic and the Mediterranean (PS, Nov. '32, p. 43). END



Sketch shows how huge cradle would be mounted on 1,200 railroad wheels. Ends of the cradle would open out like big gates for the ship to enter and leave via canals at the two terminals.

Map shows how shorter route along West Coast would save 1,000 miles—up to four days—on runs between Atlantic and Pacific ports. Line would extend between Puerto Mexico and Salina Cruz.

French Truck Lugs 130 Tons

THIS new French truck could almost carry in its cab the Renault shown alongside. One of the world's largest tractor-trailers, it weighs 75 tons and can carry a 130-ton load at about 9 m.p.h. It is 86½ ft. long, 13 ft. high, and 15 ft. wide. The eight-cylinder, 220-hp. engine has 12 speeds forward and four in reverse. The tractor was designed by Willeme and the trailer by Scari for the Lancia Co. The truck will be used in Portugal.

Big Truck Is Post Office

NEWEST addition to the Government's fleet of rolling post offices is this SuperTwin® that carries 30 percent more mail than a railway post office. It is 45 ft. long, but has a turning radius of only 35 ft., thanks to its articulated design and interconnected front- and rear-wheel steering. A vertical hinge at the articulation point (behind center axle) lets the Twin Coach Co. truck "breathe" on hills and prevents jackknifing on slippery roads.

Power for the huge mobile post office will be provided by dual Fageol® engines—giving a total of 360 hp.—mounted amidships. They are equipped with automatic transmissions.

Hinged Truck Tips Waste Out

THIS huge wastebasket on wheels (left) now trundles scrap in industrial plants. The three-ton body is hinged so that it can be tilted away from the chassis. Then the whole side drops like a gate to dump the trash easily. Called the Trash-Truk®, it is made by Service Caster & Truck Corp., of Albion, Mich.

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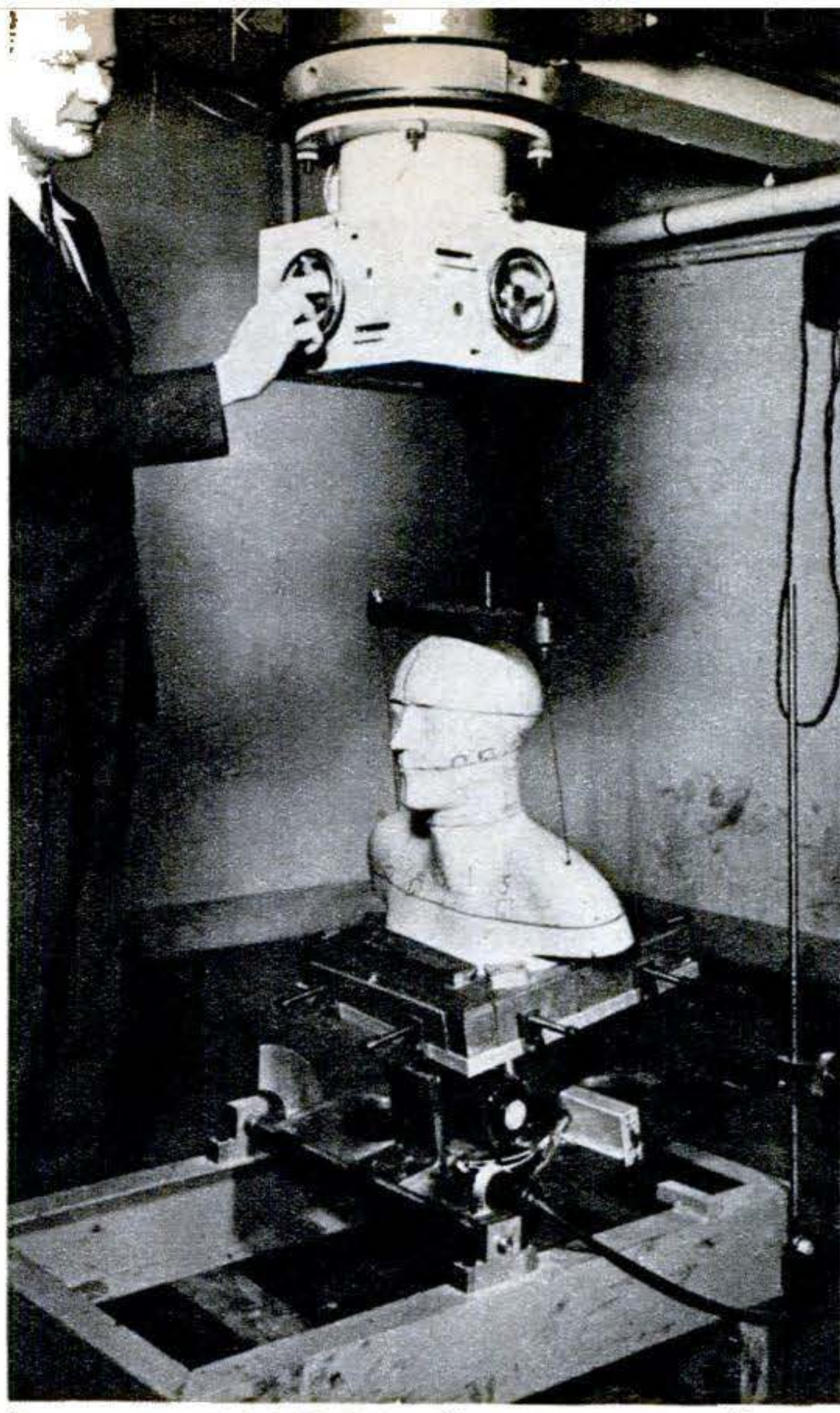
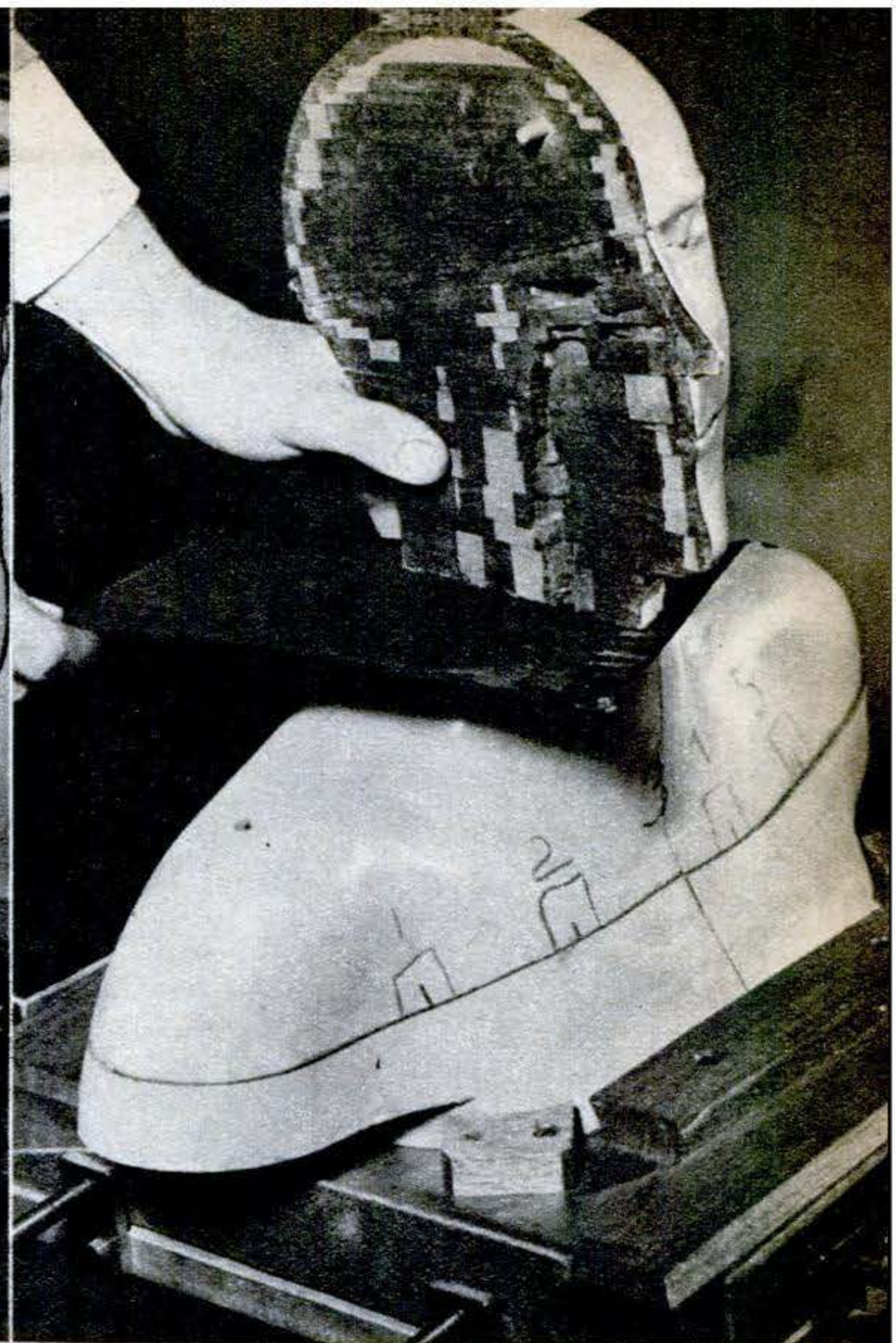


Generator of 3,000,000-volt X rays is trained on "Mr. Cruikshank," wooden phantom man, by Dr. John G. Trump of M.I.T. Dummy has probably had more X rays than any human patient in world.



Film being placed in dummy will show penetration of X rays through layers of wood and other porous materials, which closely simulate the densities of the bones, tissues, and skin of a man.

Mr. Cruikshank Tests X Rays

A WOODEN man is helping Massachusetts Institute of Technology scientists to study the medical usefulness of multimillion-volt X rays from powerful new machines.

Mr. Cruikshank, as they have nicknamed their lifelike dummy, has more than an external resemblance to a human being. His head and shoulders, built up of layers of wood and other porous materials, come close to matching the densities of bone, tissue, and skin. Therefore, X rays fired at him will penetrate about as deeply and with the same effectiveness as they would in the same parts of a human being.

Since the helpful Mr. Cruikshank has the additional advantage of being sectional, X-ray film may be inserted at various places in his anatomy. When the films are developed after a test exposure, they show the amount of radiation that would penetrate to a corresponding depth in the human body.

Devised by Dr. John G. Trump and Dr. J. Eugene Nelson of M.I.T., Mr. Cruikshank has been receiving a series of test exposures under 3,000,000-volt X rays from a Van de Graaff electrostatic generator (an atom smasher used in cancer treatment and nuclear research). For comparison, he will next undergo treatments with conventional 250,000-volt X-ray machines, as a "patient" at the Massachusetts General Hospital.

Much as a projectile's range may be augmented by increasing the propelling charge, X rays are known to take maximum effect at a depth that increases with their voltage. Using suitably stepped-up voltage, doctors now hope to concentrate the rays upon deep tumors without harming the skin or intervening healthy tissue. The M.I.T. studies, supported by a research grant from the American Cancer Institute, aim to perfect this sharpshooting technique. END

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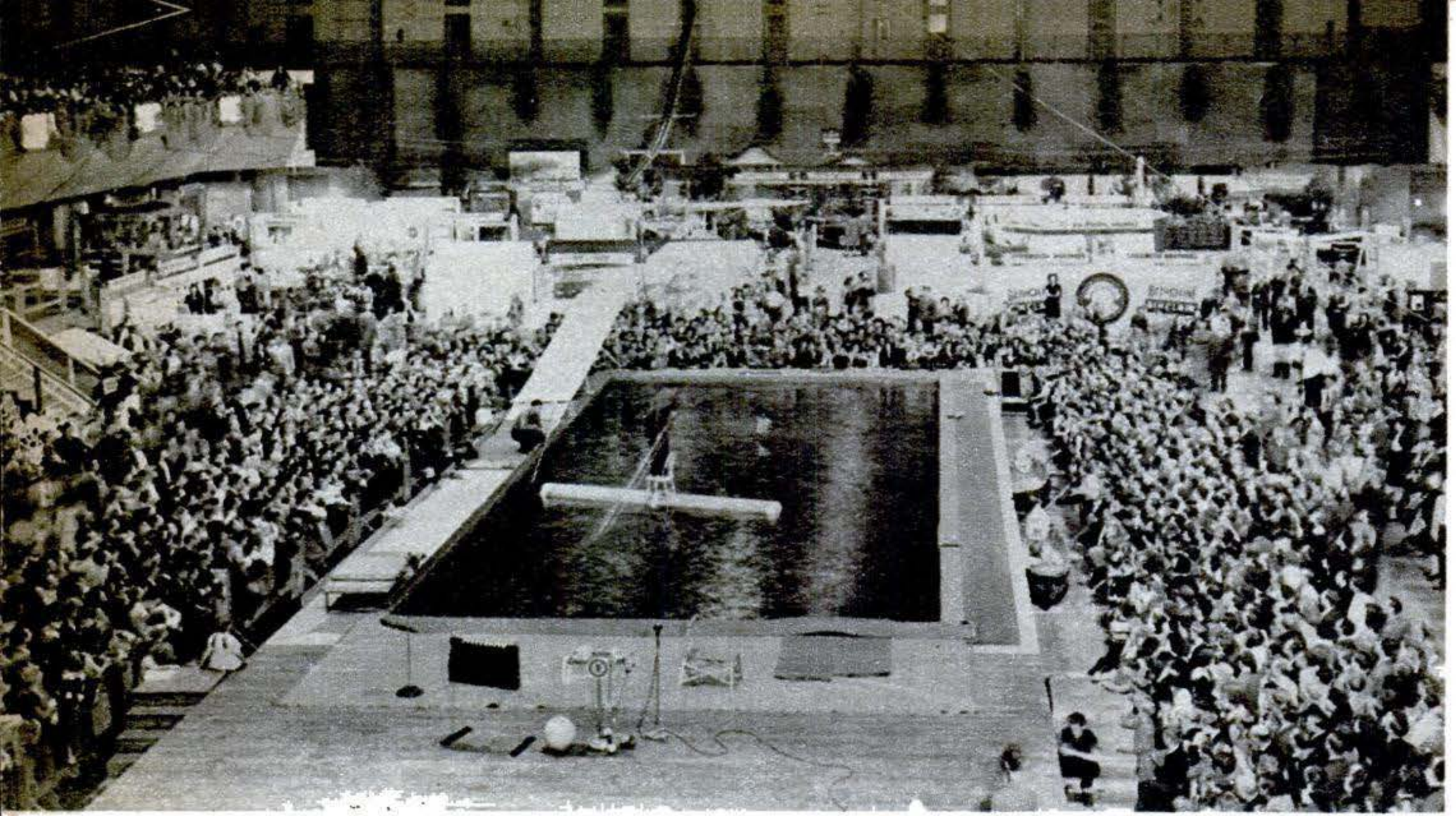
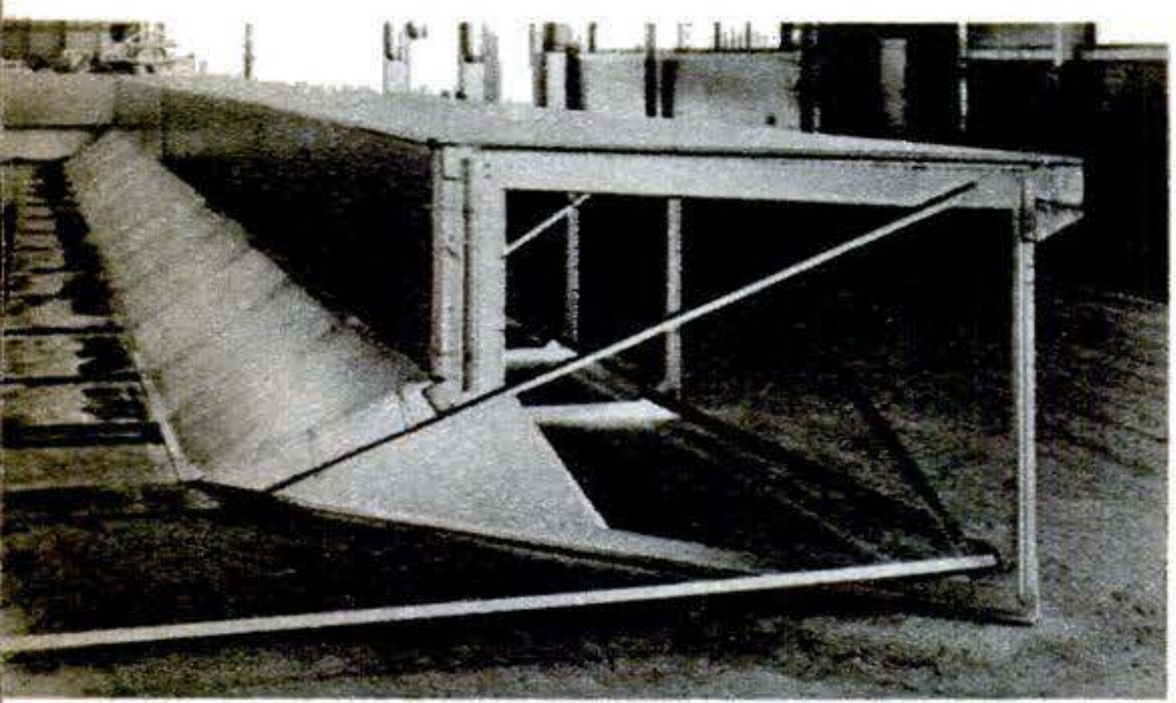


Baltimore armory crowd thrills to a log-rolling contest in dismountable plastic swim tank.



Aluminum framework of Martin-developed water tank is shown above partly assembled. At left is basin for plastic-coated duck liner. Part of walkway bordering pool is seen at the right.

Plastic sheeting to line pool is unfolded a panel at a time, and spread manually over surface and sides of structural framework. Workmen's shoes are covered to protect coated surface of liner.

68-Ft. Pool Folds Up

WHEN the League of Maryland Sportsmen decided to add aquatic events to their annual show in one of Baltimore's strictly landlubber armories, Glenn L. Martin engineers and chemists came to the rescue with a tailor-made, come-apart swimming pool.

The engineers designed and built a dismountable aluminum frame, 32 feet wide, 68 feet long, and 4 feet deep. Meanwhile, the chemical boys had developed a heavy-duty duck material, coated with Marvinol® plastic, to line the tank. To make it watertight, its rectangular component strips were stitched together with vinyl dope. Combining flexibility with strength, the plastic tank holds 32,500 gallons of water, or some 600 times its own weight of 437 pounds. For storage, it can be folded into a compact bundle about four feet square.

The structural elements, besides the pool framework, consist of a walkway all around, a platform, and portable ramps and steps. Dismounted, the equipment occupies less than 1,000 square feet of storage space.

It takes a dozen men about three working days to put up the structure and install the plastic pool liner. With a fire hose, the tank can be filled in three hours.

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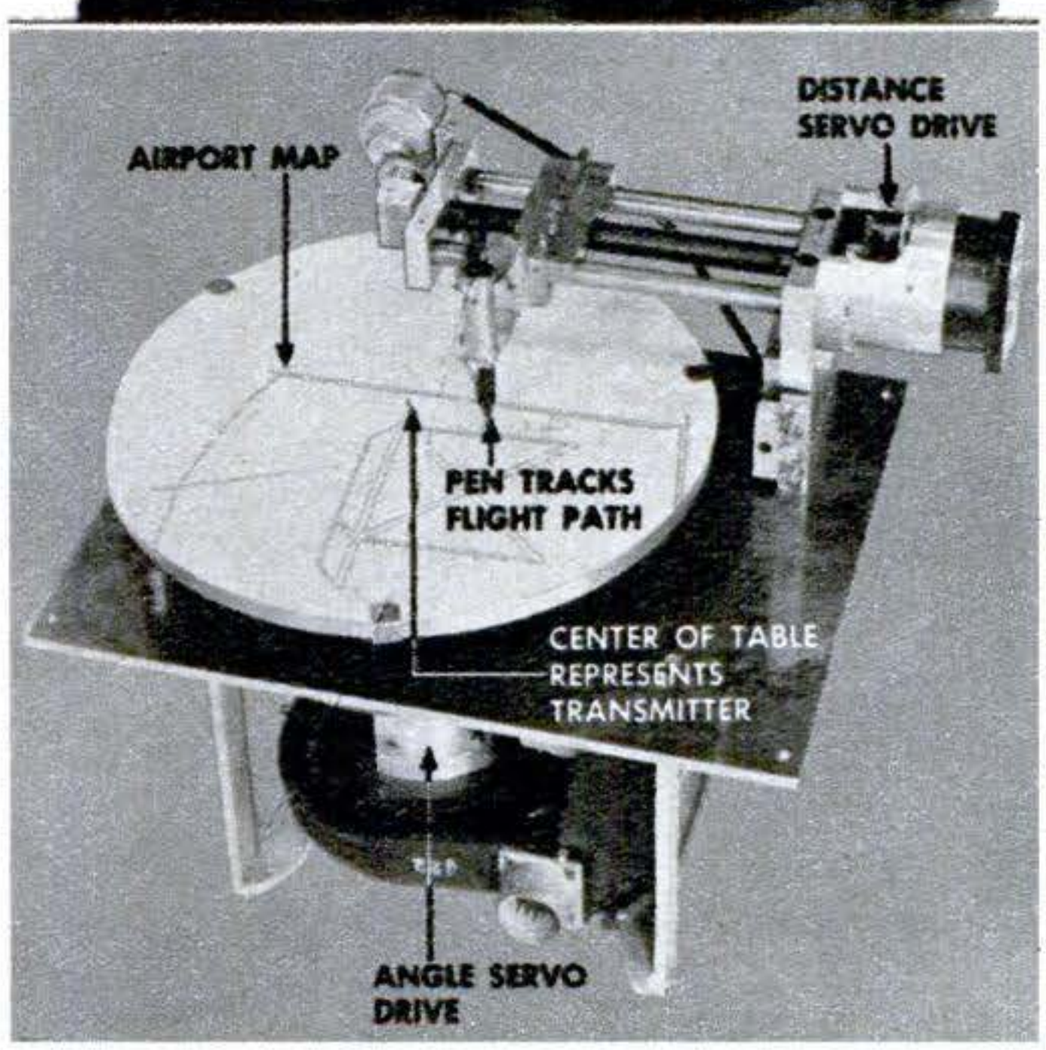
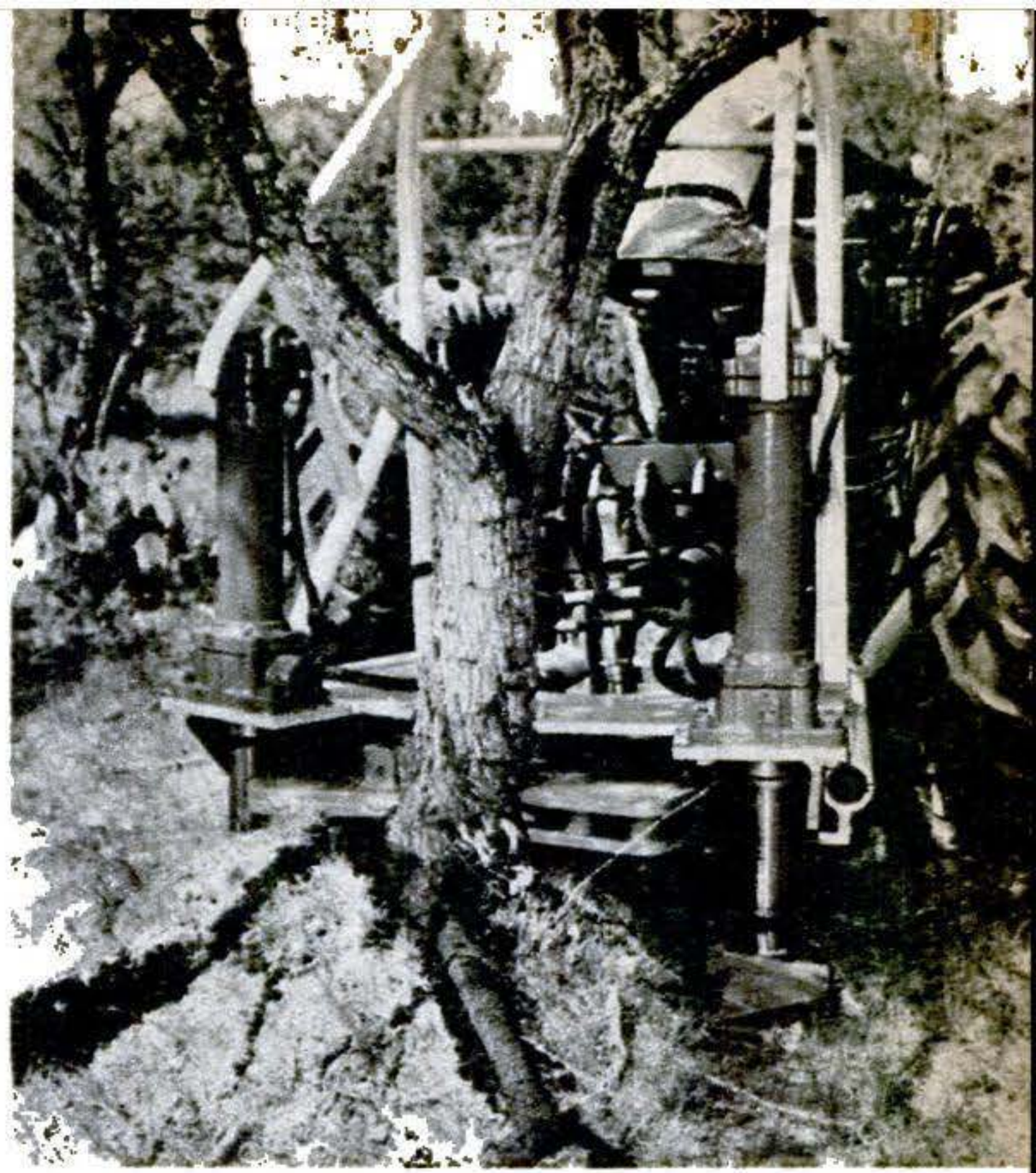


Bread Truck Keeps on the Beam

AUTOMATIC air navigation devices of tomorrow are going through their growing pains in a converted bread truck. "Flying blind," it has worn out more than one set of tires up and down the runways and taxi strips of MacArthur Field, the Sperry Gyroscope Co. research center on Long Island, N. Y.

Blind "flying," with the truck's driver sitting "under the hood" and "piloting" down the runway on instruments, is an old story. More recently, the unique vehicle has been used to evaluate a new position finder for pilots that continuously traces a plane's position on a map. Microwave signals are transmitted by a ground station. This information is interpreted by electronic devices that in turn plot an exact course on a map on a turntable, shown in lower photo above. Thus a pilot can see exactly where he is at all times even though he cannot see the ground, and he can fly in zero-zero weather without the use of the usual blind-flying instruments.



Pulled Out by the Roots

THERE is no danger of a second growth when trees, up to nine inches in diameter, are pulled up by this one-man machine developed by San Antonio's Institute of Inventive Research. It is hydraulically operated by power taken from any tractor developing 26 hp. at the belt. As shown above, powerful jaws dig in and grip the roots. Then two lifting cylinders, each exerting 20,000 pounds of pressure, complete the big extraction.

Jeep Delivers Torpedoes

CRADLING a pair of torpedoes at its sides, this little car resembles some futuristic rocket vehicle. The "torpedo jeep" serves to trundle the missiles between the torpedo repair shop of the Naval Submarine Base, New London, Conn., and submarines moored at the dock. For practice use, standard 20½-foot-long torpedoes are fitted with dummy heads of the same weight as explosive war heads.

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How Linemen Handle Hot Wires And Stay Alive

It takes years to train a high-tension man to work with death only an elbow away—and keep it there.

By George H. Waltz, Jr.
PS photos by Hubert Luckett

THE summer's first big electrical storm had hit. Lightning, wind, and falling trees knocked out a power line. A third of the town was plunged into darkness—including the hospital. When its superintendent frantically called the power company, he was told: "You'll have electricity within half an hour." Just 22 minutes later the lights flashed on.

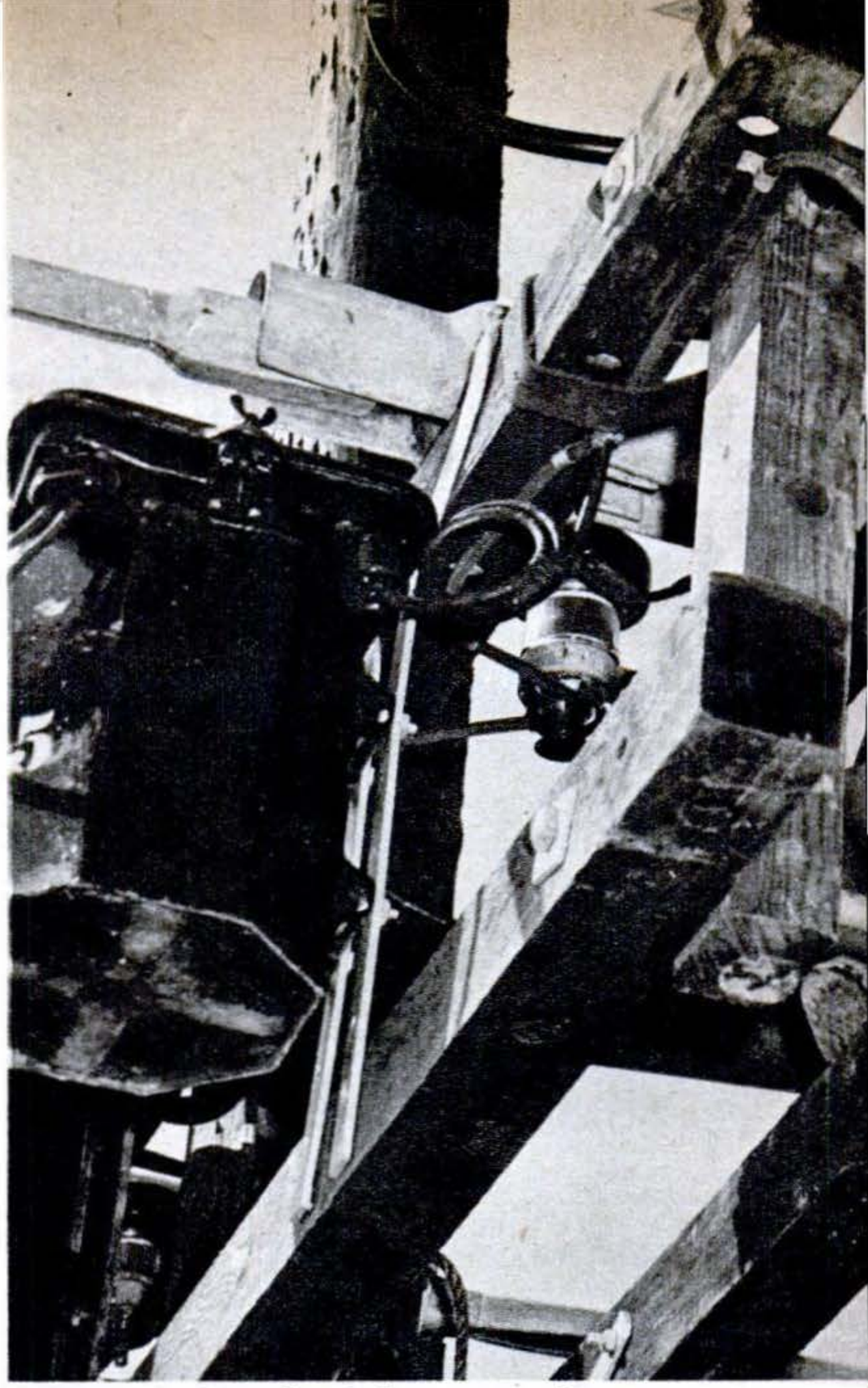
Emergencies like this break suddenly upon thousands of communities every year. But in spite of hurricanes, ice storms, blizzards, floods, and direct hits by thunderbolts, vital electricity is kept flowing across the country with a minimum of interruption.

How do our power companies perform these high-speed repair miracles?

Part of the answer is two-way radio, special equipment, and trucks that are complete mobile workshops for the line crews. But a bigger part is the skill and versatility of the pole-climbing linemen themselves.

Each lineman who has won his climbing spurs is a mechanic, electrician, woodsman, aerialist, carpenter, gadgeteer, and first-aider all in one. I saw all these skills in action when I recently spent a week with an emergency crew of the Public Service Electric and Gas Company of New Jersey.

There was a time years ago when linemen were rugged rovers who went wherever there was work. They prided themselves on how fast they could climb a pole and come down

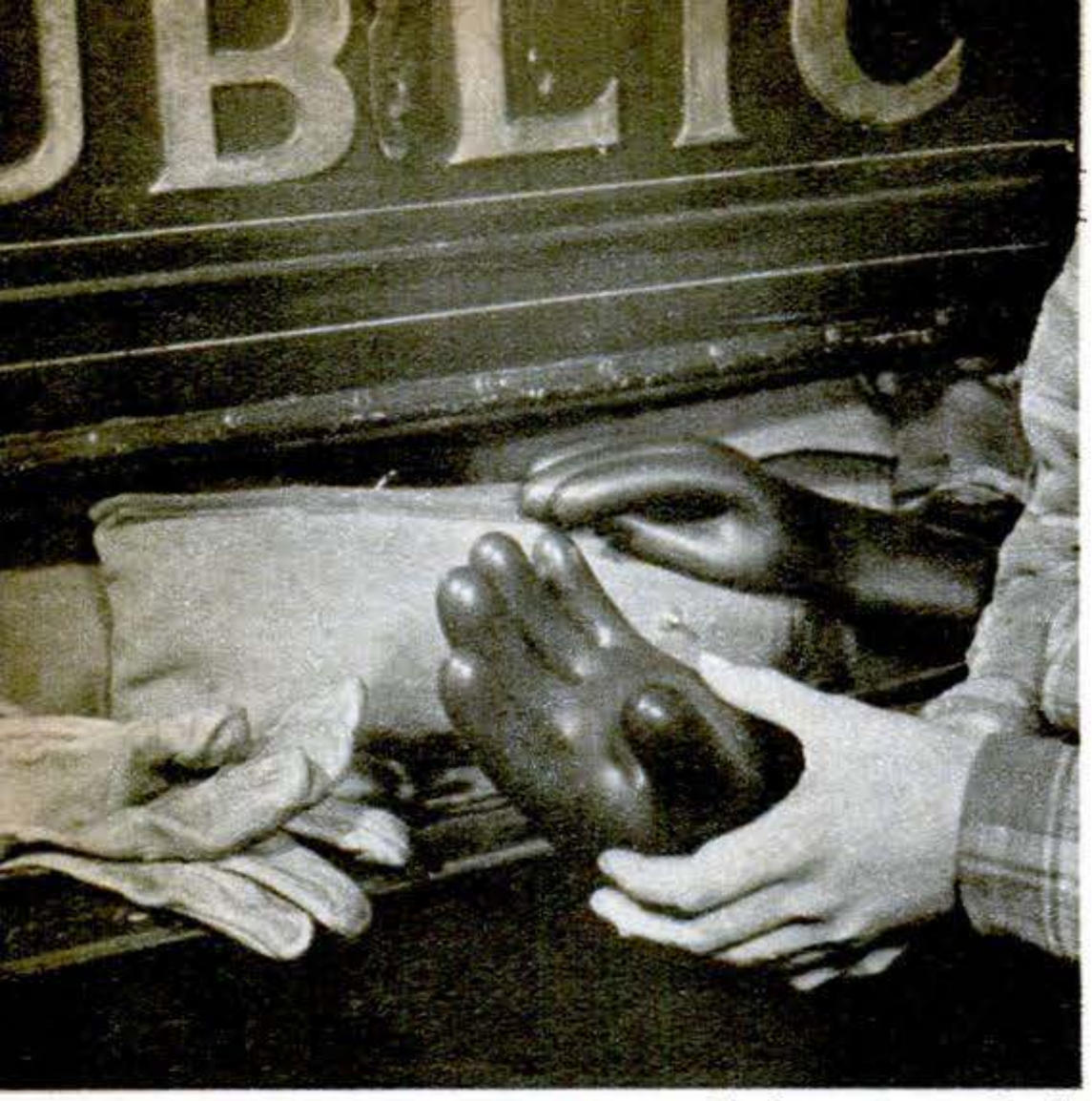


Held only by his safety belt, a veteran lineman

What well-dressed lineman wears is shown below and at right. Hands and arms are completely

hangs far out in space to repair a power line. But he had to go to school to learn how.

covered by heavy rubber gloves and sleeves. Rest of outfit includes climbing irons, goggles, and body belt that holds tools and safety belt. Peaked cap shields head, shades eyes against sun glare.



Linemen test rubber gloves before each climb by filling them with air, closing the wrists, and squeezing. Any air leaks then show up tiny, pinpoint holes that would be extremely dangerous.

As lineman climbs up pole, he covers all wires he must pass with long, tubular, slip-on insulators called "line hoses." Where voltage is high, all wires are covered with rubber protectors.

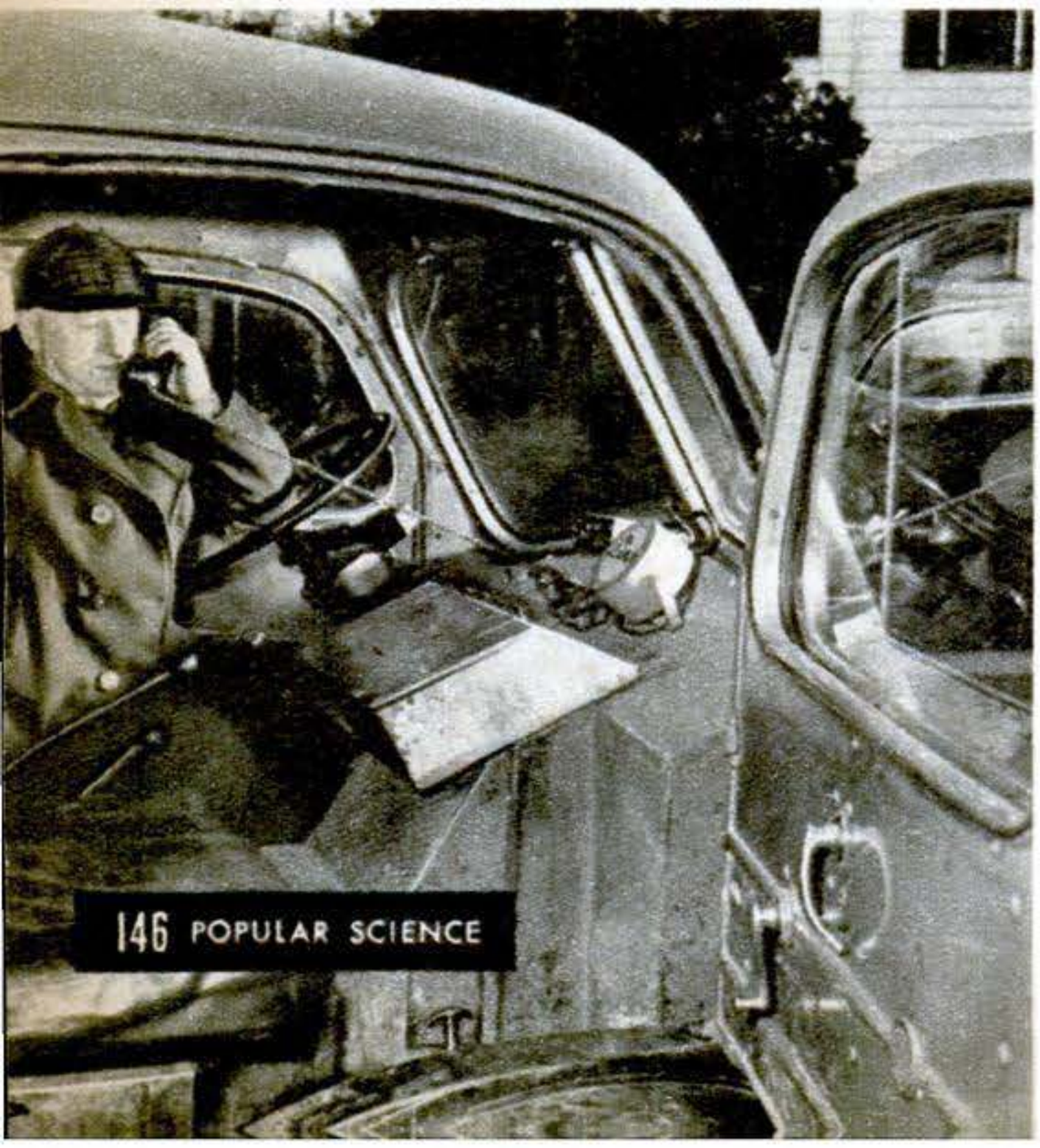
in two or three jumps. They learned to be linemen by experience—and often suffered, sometimes fatally, from lack of experience.

Not so today. In most cases it now takes a lineman longer to win his Grade I spurs than it does a college student to get his degree. After spending three years as a line helper, or "groundhog," he then divides his time for the next two years between the linemen's school and actual work in the field under old-timers. Speed in getting up and down a pole no longer is the lineman's goal. One of the first lessons he learns is that haste not only makes waste but also danger.

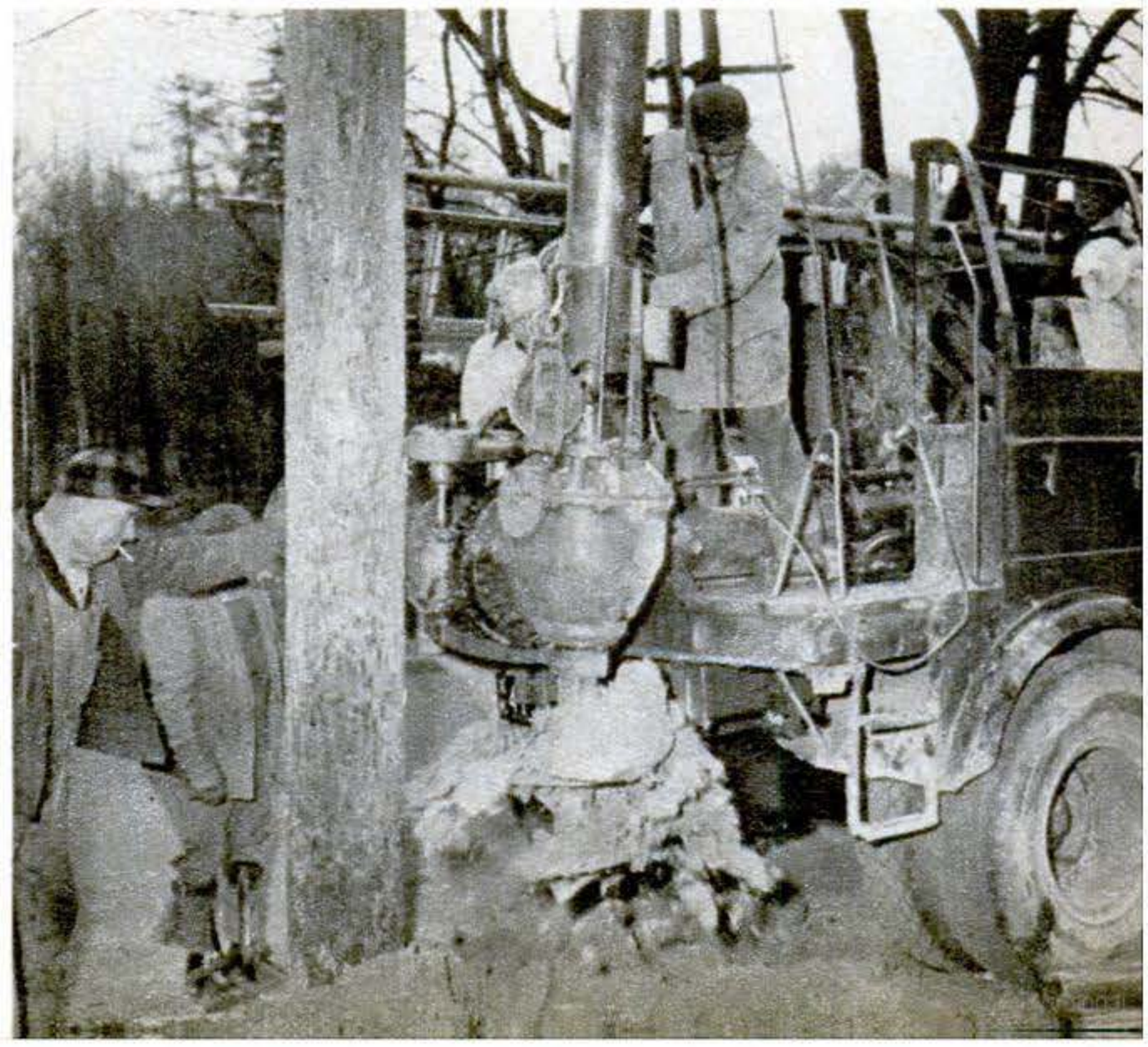
Let's follow the typical career of a young man we'll call John Clure. When John graduated from his New Jersey high school, he heard that Public Service was looking for linemen trainees. John had always been handy with tools; but, being an athlete and liking the outdoors, he couldn't quite reconcile himself to a stuffy bench job indoors. Line work seemed like a good way of combining his abilities.

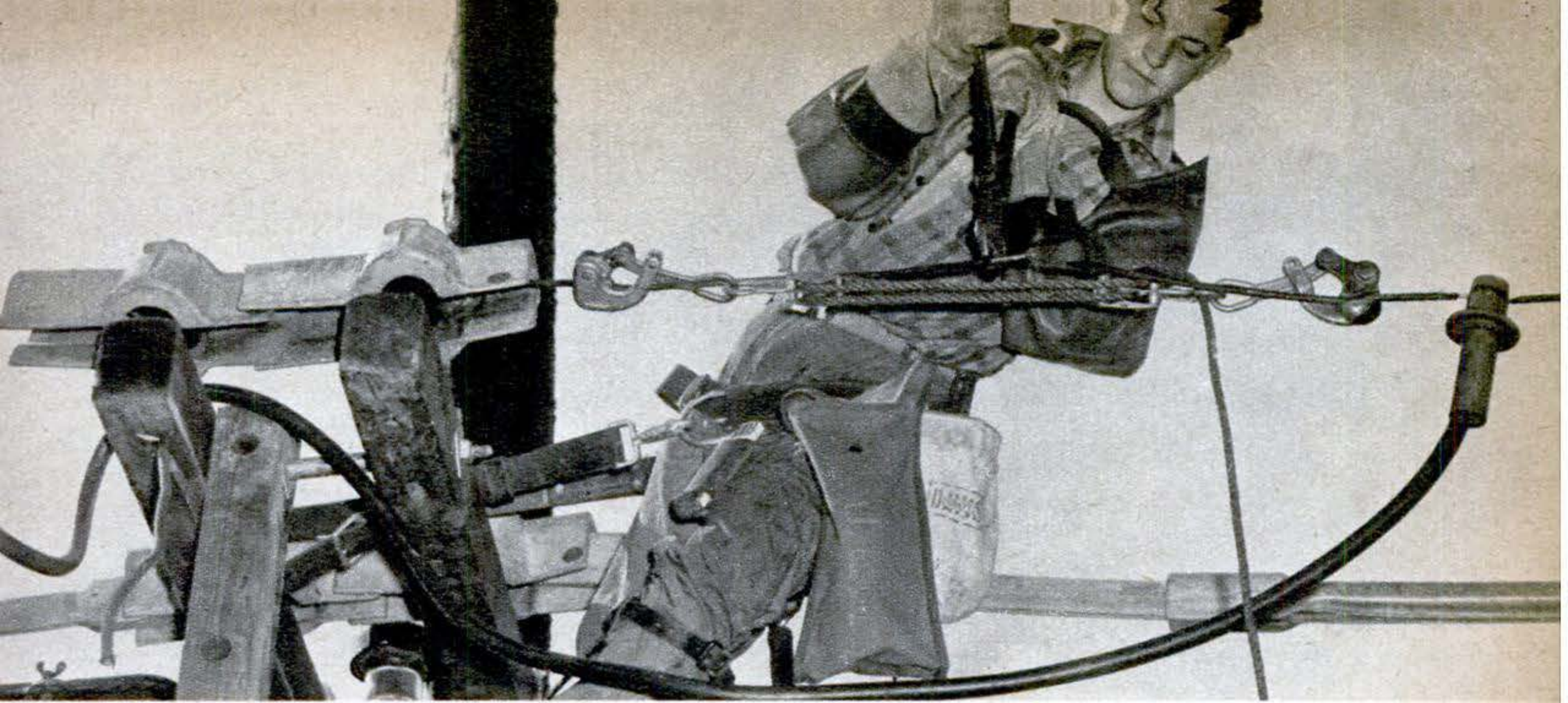
That summer John began as a helper on a line crew. For the next 36 months, he toted, shoveled, wielded an axe, and learned to use a pike—the long, steel-pointed poles used to

Two-way radios in line trucks speed emergency repairs by keeping field crews constantly in touch with central dispatcher who directs trucks, issues orders, and co-ordinates activities of crews.



New pole holes are quickly dug to right depth by a mechanical auger mounted on the rear of a special truck. A derrick, also mounted on the truck, then lifts the pole and lowers it in place.





Broken power lines are reconnected by a mechanical splice called a compression connector. Hand splices are seldom used, although all linemen know how to make them. Heavy cable clipped on wire to right of lineman is mechanical jumper that shunts current around break until it is repaired. This permits linemen to work directly on live wires without shutting off power.

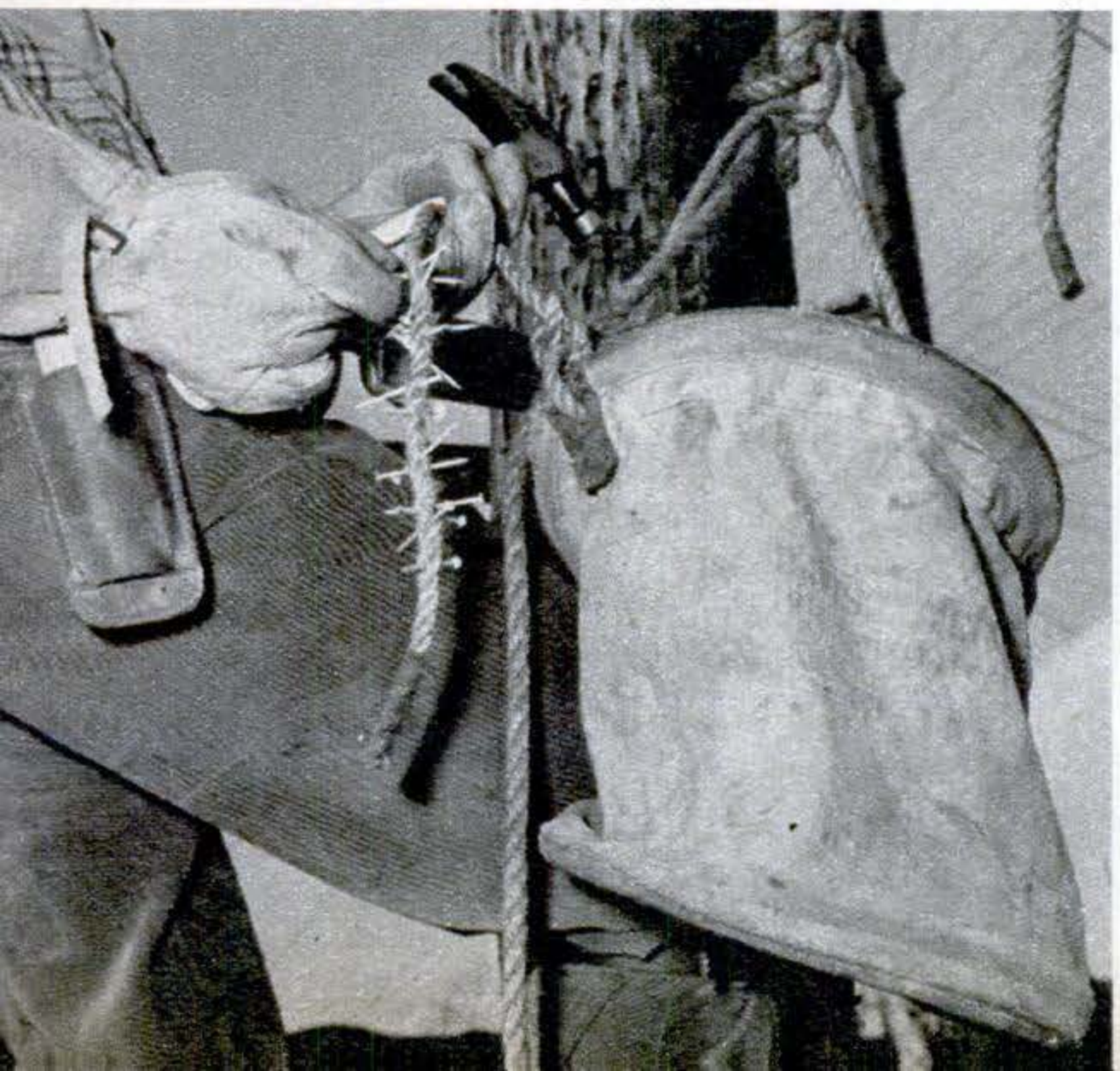
maneuver a line pole into place. When it came time for John to go to line school, he had a good ground's-eye picture of the job he hoped to fill.

Lineman Stakes Life on "Gaffs"

At school, the first thing he learned was that his climbers were his most important pieces of personal equipment. From then on his life would depend on them. He was shown how the metal spurs or gaffs must be kept sharp by filing them to a special three-sided point to match a gauge. His instructor showed him how a poorly sharpened gaff can cut out of a pole and possibly cost him his life. For the first time, he strapped on his "waistline workshop," the body belt that holds a lineman's pliers, skinning knife, wrenches, parts bag, screw driver, folding rule, connectors, a bag for his all-important rubber gloves, and safety belt. By the end of his first school day, John had taken his first timid step up a practice pole in the school's pole yard.

During this early stage, John was a "termite," the name often jokingly given new linemen because of the mounds of chips that pile up around the practice poles.

Picking up small nails would be difficult trick for lineman wearing heavy gloves, so nails are hoisted up to him stuck through rope. When he needs one, he simply pulls it out of the rope.



To cut high-tension wires, linemen use special wood-handled hack saw, never ordinary wire cutters. Note how surrounding lines and insulators have been covered with "hoses" and "hoods."

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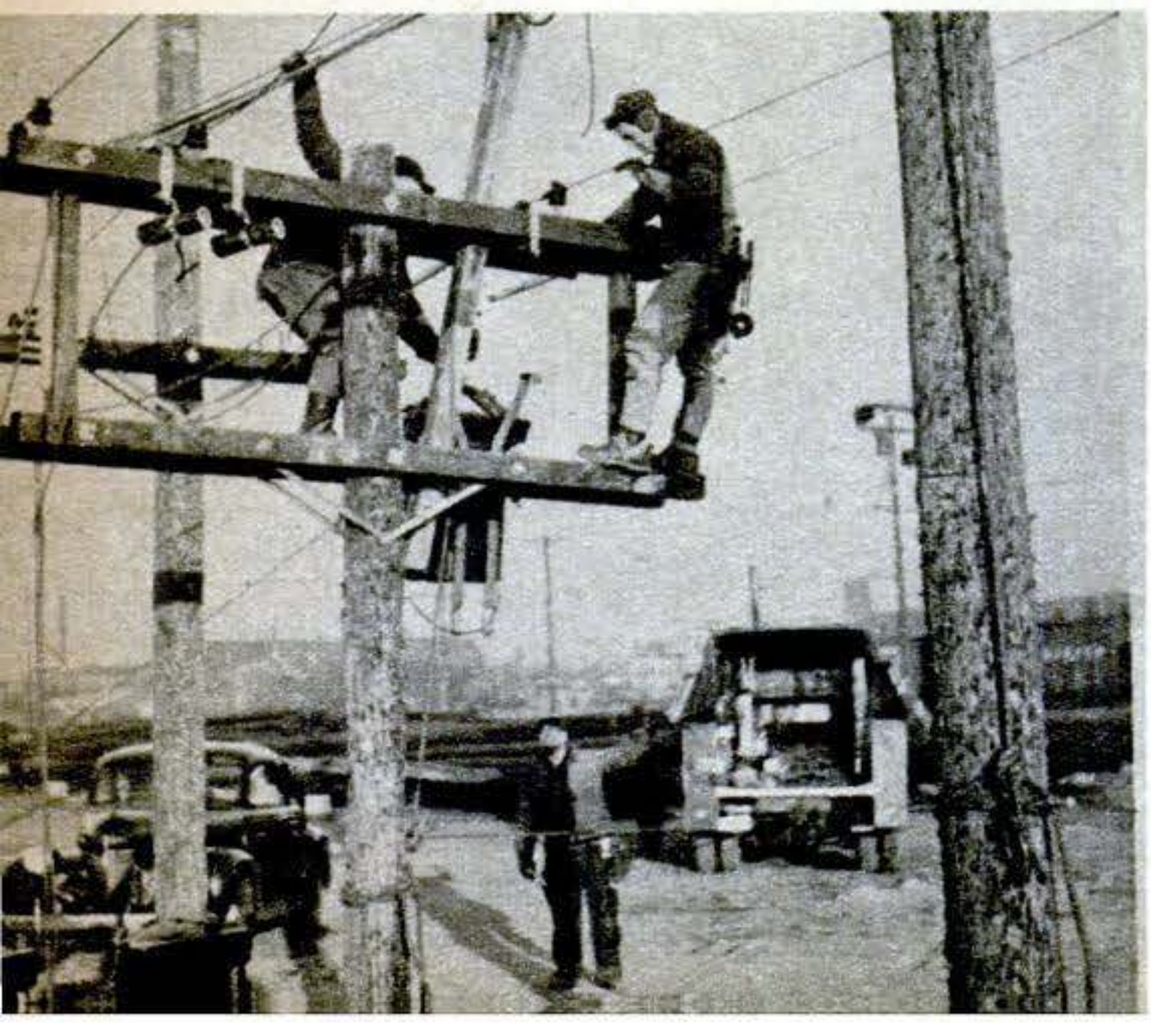
Linemen steady new pole with long, steel-pointed "pikes" while hole is filled in. Wires from old pole, removed but still standing, will be transferred to new one when it is firmly in place.

No termite could do a more thorough job of chewing up this practice pole than spurs of student linemen. The pile of chips at base of pole shows why trainees are aptly dubbed "termites."

Learning from the ground up – literally. Students practice on stub poles that are exactly like real ones – except closer to terra firma. Here they perfect their skills and gain confidence.



The tenth day in school found John perched at the top of a 40-foot pole for the first time. He had worked himself there by easy stages, climbing a little higher each day. John admits now that he felt a little scared that first time at pole top, but he wasn't half as upset as one boy who two-thirds of the way up literally froze to the pole with fright. He could move neither up nor down, and his instructor finally had to climb up and bring him down.

An instructor likes to pick a slightly overcast day for this important pole-top test, the kind of day when clouds are scudding across the sky. He then orders each beginner to climb his pole with his back to the oncoming clouds. If a student has the slightest tendency toward dizziness or height fright, one look at the sky will make it blossom out like measles. The clouds, passing over him from back to front, make him feel that he is falling backwards. If he can't shake off the illusion, he is likely to freeze, grabbing the pole with both hands and hanging on. This is the student lineman's first big hurdle.

John Learns on a "Stub" Pole

For six weeks, John learned his pole work literally from the ground up. Each new problem of construction and wire work he first solved at the top of a "stub" pole just a few feet off the ground. As he became more confident, he proceeded higher and higher to pole top. A lineman not only has to become apt in each of the many jobs he has to perform, but he has to feel at home resting on his climbers and safety belt.

As one veteran lineman put it: "You've got to be relaxed up there. Handling hot wires, you've got to concentrate on the job –not on your legs and spurs. The first couple of months are tough. You're dog-tired before the day is half over. Going up, you dig your spurs in too deep and then have to use extra effort to pull them out. Topside, you stiffen up. You haven't learned yet to relax and lean back on your belt. But you'll get it, and then it'll be easy."

At the end of seven weeks of basic training, John left the line school as a Grade II lineman and reported to a line crew for his first real field work. But here again he progressed by easy stages. His pole work was limited either to working alone on low-voltage lines that were dead, or working with another qualified Grade II lineman on low-voltage lines that were alive.

For the next year and a half, John shuttled

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back and forth between the school and the field, learning more at each stage. At the end, handling high-tension wires was relatively safe and easy at just about any height. He was a Grade I lineman.

Safety becomes second nature to a well-trained lineman. From the time he was a groundman he has worked with a hat on and his shirt sleeves rolled down even in the hottest weather. Rolled-up sleeves may be more comfortable on a sizzling summer day, but unabsorbed perspiration on bare arms can cause deadly current leakages around a lineman's gloves and rubber sleeves.

He knows the danger of finger rings, watches, fasteners, and key rings. Any piece of metal, even a metal button on his cap, can help to form an accidental spot contact for high-voltage current. Before he climbs a pole, he tests his rubber gloves for dangerous leaks. He fills them with air and holds them closed by folding and rolling down the wrists to make sure they hold the air and have no pin-point holes. Then he pulls leather protecting gloves over the rubber gloves. If he is going to work around high-voltage wires, he puts on his rubber sleeves.

As he climbs toward pole top, he covers all nearby wires with rubber blankets and slip-on insulators called "line hoses" and "insulator hoods." "Covering up," as the linemen call it, is the first step on every job. Often a lineman will spend half an hour "covering up" to make a repair that takes less than five minutes!

Even "Dead" Wires Can Kill

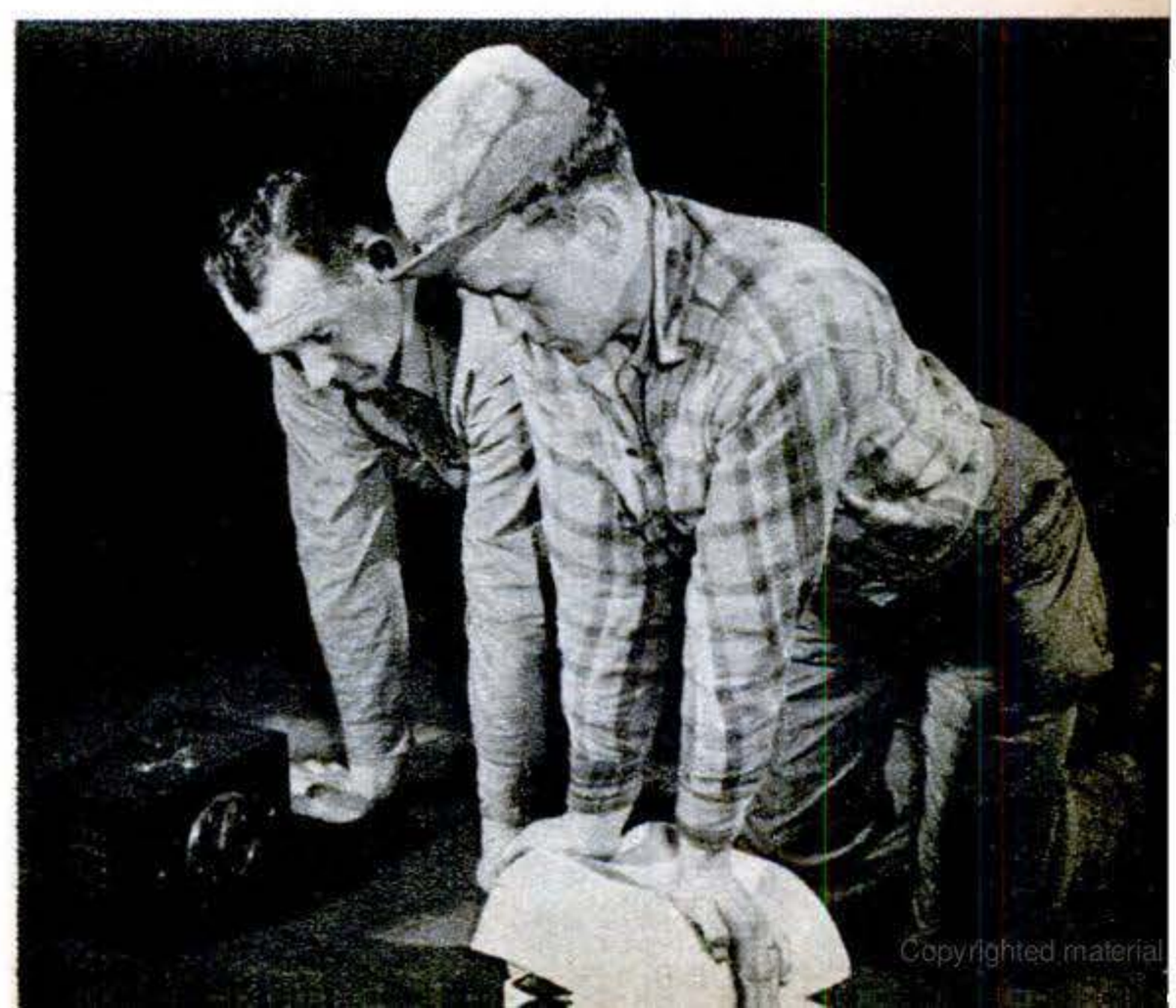
He has learned to regard any wire, "dead" or "alive," with the utmost respect. He knows that under certain conditions even a "dead" wire can give him a fatal jolt. A long, unconnected wire stretching for many miles, particularly at the high altitudes encountered when stringing power lines over mountains, can develop a charge of static electricity heavy enough to kill a man.

Ask the average lineman what he does with his spare time and you'll probably find that his yen for using his hands and building things doesn't stop when he puts away his climbers at the end of a day. The chances are he'll tell you he spends a good many of his evenings either in his home workshop or doing odd jobs around the house—something different like rewiring a living-room lamp or fixing the vacuum cleaner. He'll tell you, too, that he handles 110 volts with as much respect as any high-tension line. END

Lineman's life depends on his climbing irons. To prevent them from cutting out, they must be kept filed to special three-sided point. Here metal gauge is used to check accuracy of shape.

Linemen must learn to be fire fighters, too. Here one battles a hard-to-reach, pole-top fire with an extinguisher containing a special mixture of carbon dioxide and carbon tetrachloride.

In case of accidents, linemen must be able to apply artificial respiration — even at pole top. Mastery of prone method is aided by scales and timer to show the proper pressure and timing.



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Mechanical Milker Traps Bacteria

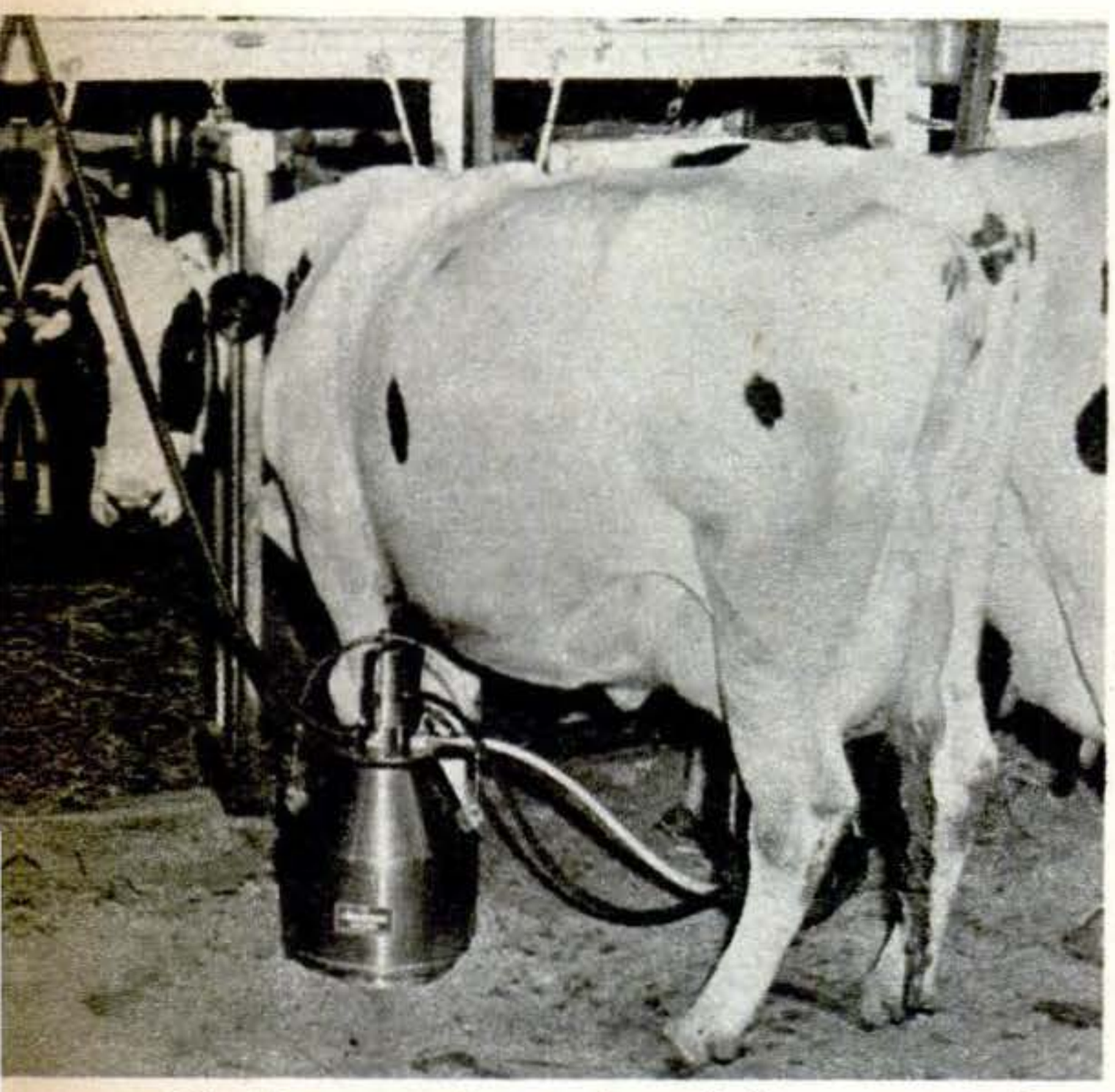
Milk can easily be contaminated at the source. This new machine guarantees a pure flow from the cow to the pail.

By Herbert Johansen

THE cleanest cow is no guarantee of pure milk. Mechanical milkers, machines through which hundreds of millions of gallons of milk pass yearly, can be a source of serious contamination. This is often caught by inspection, but the farmer takes a loss.

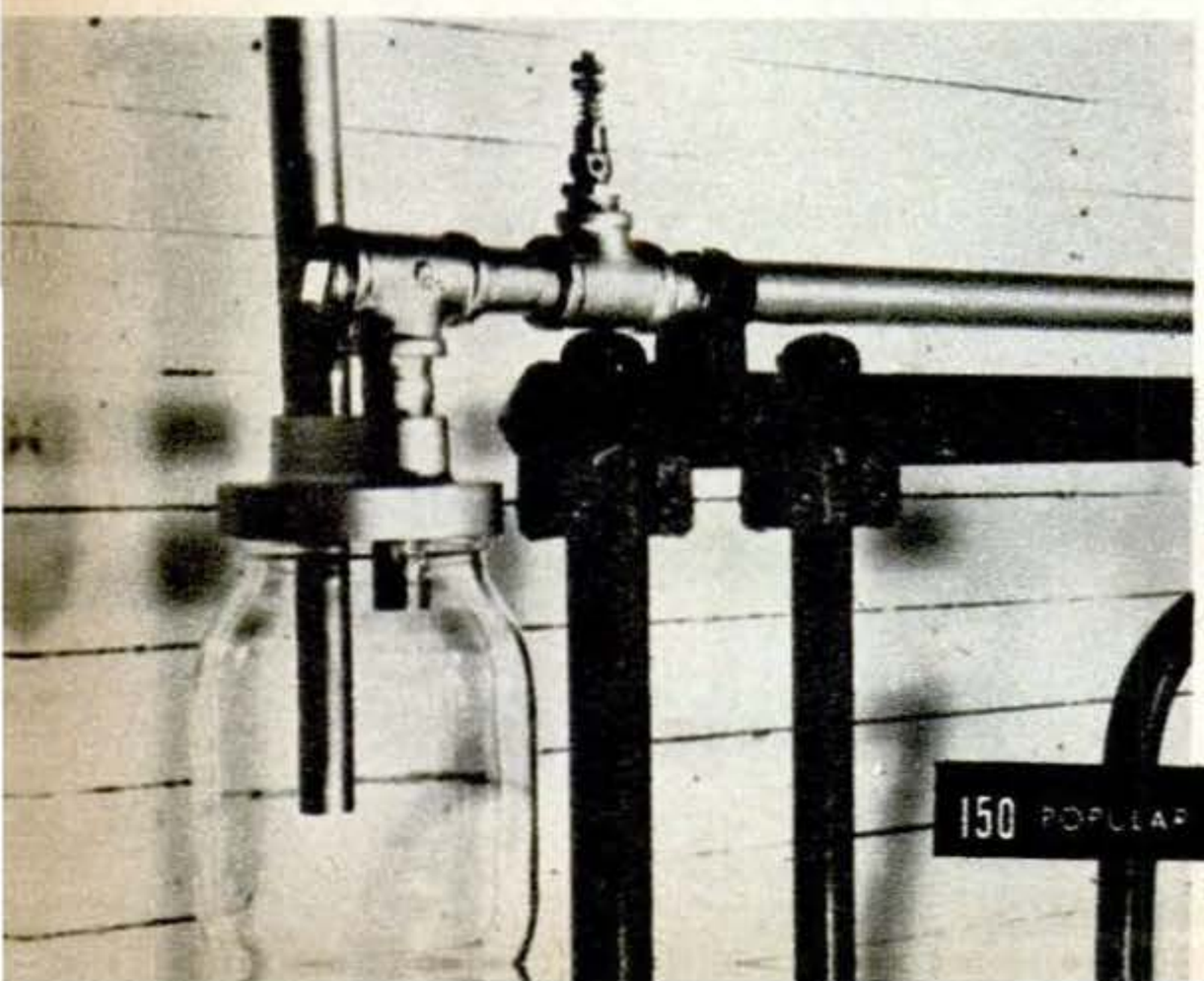
And, contrary to popular belief, certain types of bacteria, especially dangerous to infants, are not killed by pasteurization.

Aware of this danger, New York City's Health Department called for a "safe" milking machine. The challenge was met by Kurt Schneider, engineering chief of American Separator, Inc., Bainbridge, N. Y., whose foolproof mechanical milker is shown here.

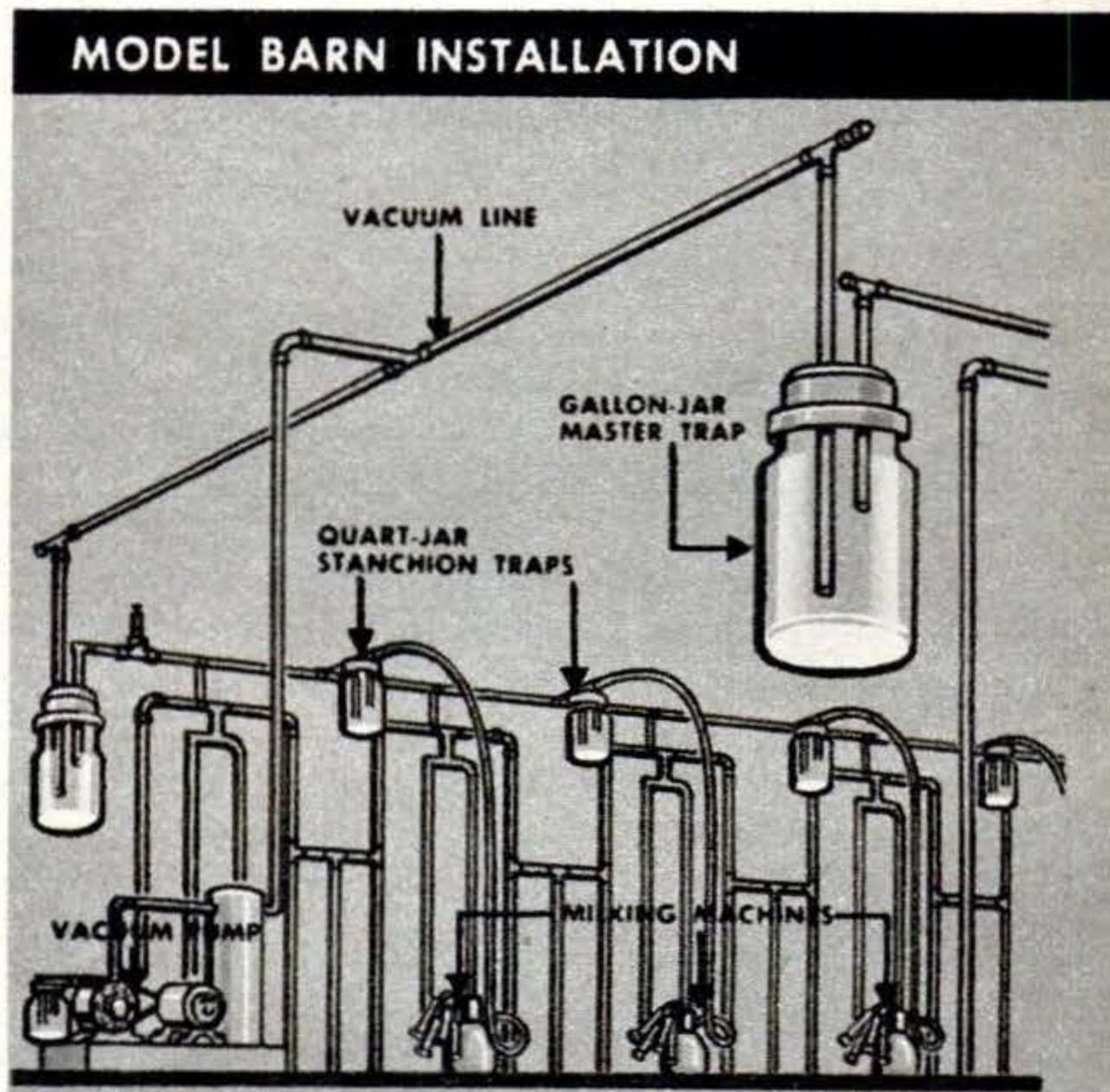


Placid expression on bossy's face seems to bear out the inventor's claim that the new safe milking machine is pleasing to the cow as well as being efficient and more sanitary than old-type milkers.

Close-up below shows one of the gallon-jar bacteria traps placed at end of each stanchion-line section. Contaminated liquid caught in it cannot flow back into pipe line and get to milk pail.



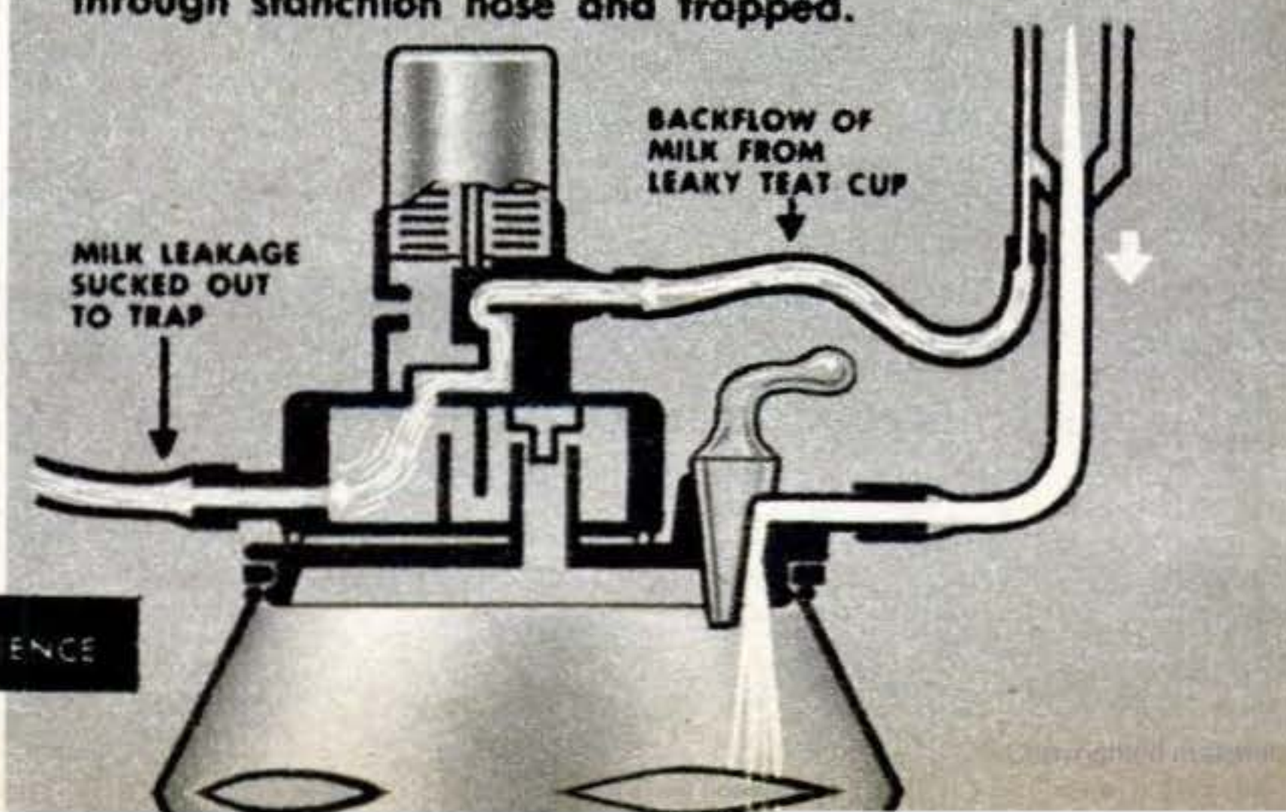
MODEL BARN INSTALLATION



Drawing above shows vacuum pump, pipe line, traps, and milking machines in individual stalls. Quart Mason jars, attached to each stanchion, trap bacteria before they reach vacuum line.

THREE WAYS IN WHICH

Milk leaking from the teat cup is withdrawn through the pulsation hose. Instead of collecting, and contaminating the machine, it is sucked out through stanchion hose and trapped.



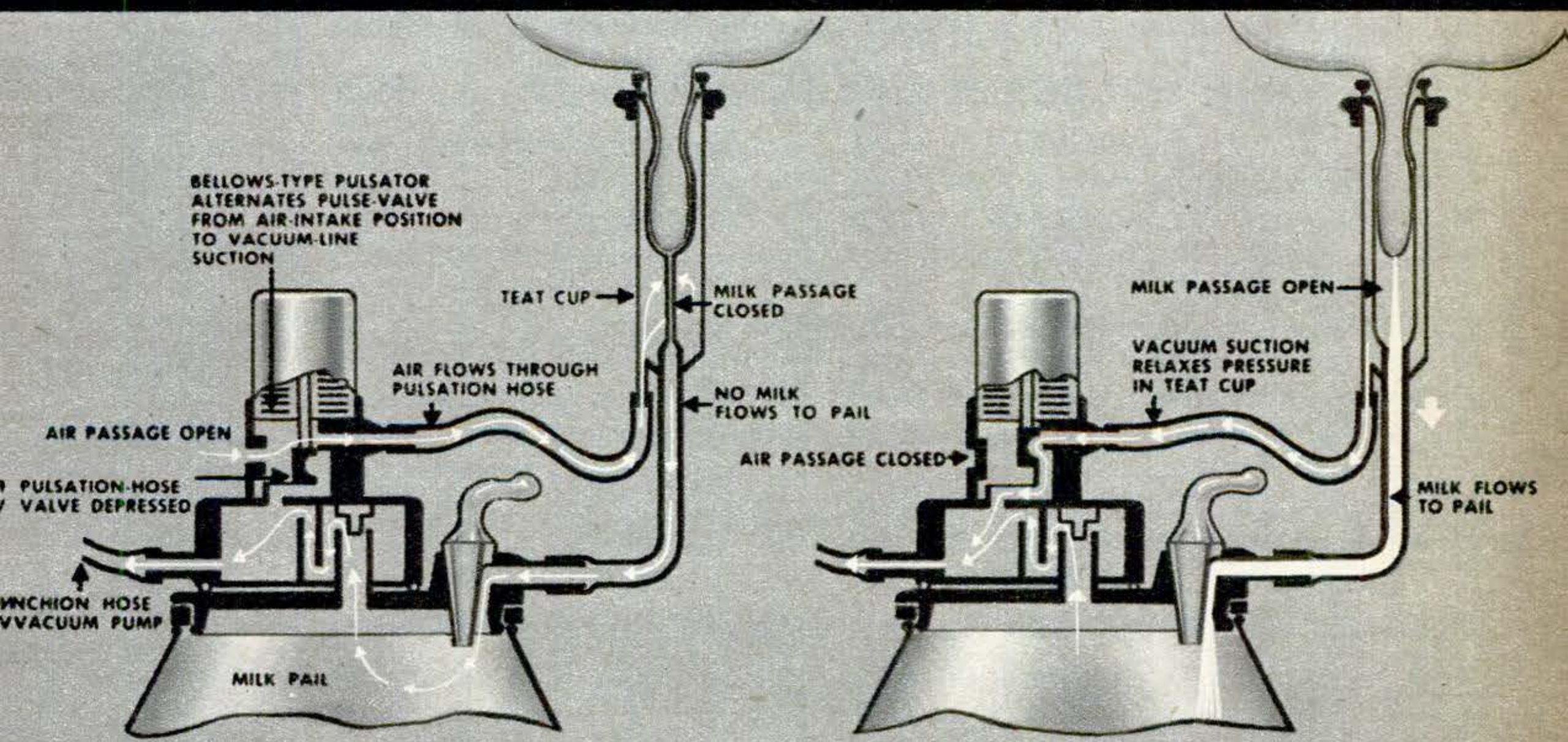
The No. 1 danger point has been in the vacuum lines supplying the pulsating power that gives the milking machine the massage action of hand milking. Milk or foreign substances drawn into the lines quickly decompose, and bacteria multiply rapidly. This highly poisonous matter is frequently sucked back into the milk pail due to pressure differentials in the vacuum line.

A series of protective traps—quart Mason jars—along the vacuum line have proved effective in stopping this backflow. In a recent test, conducted after a single milking, milk in a pail showed a low bacteria count of 20,000 per cubic centimeter. Material caught in just one of the jar traps, however, showed a count of 558,000,000 bacteria per c.c. If this had reached the pail, the bacteria count of the milk would have tripled.

The milking unit itself is another source of contamination. Cleaning the pulsator has always been a problem. In the new machine, this has been solved by using a new bellows-type pulsator that is completely isolated from other working parts.

According to Schneider, the new design plus the traps make it impossible for any milk to get into the pail from either the vacuum line or working parts of the machine. The pail gets only what the cow gives. END

WHAT GOES ON INSIDE A MACHINE DURING MILKING



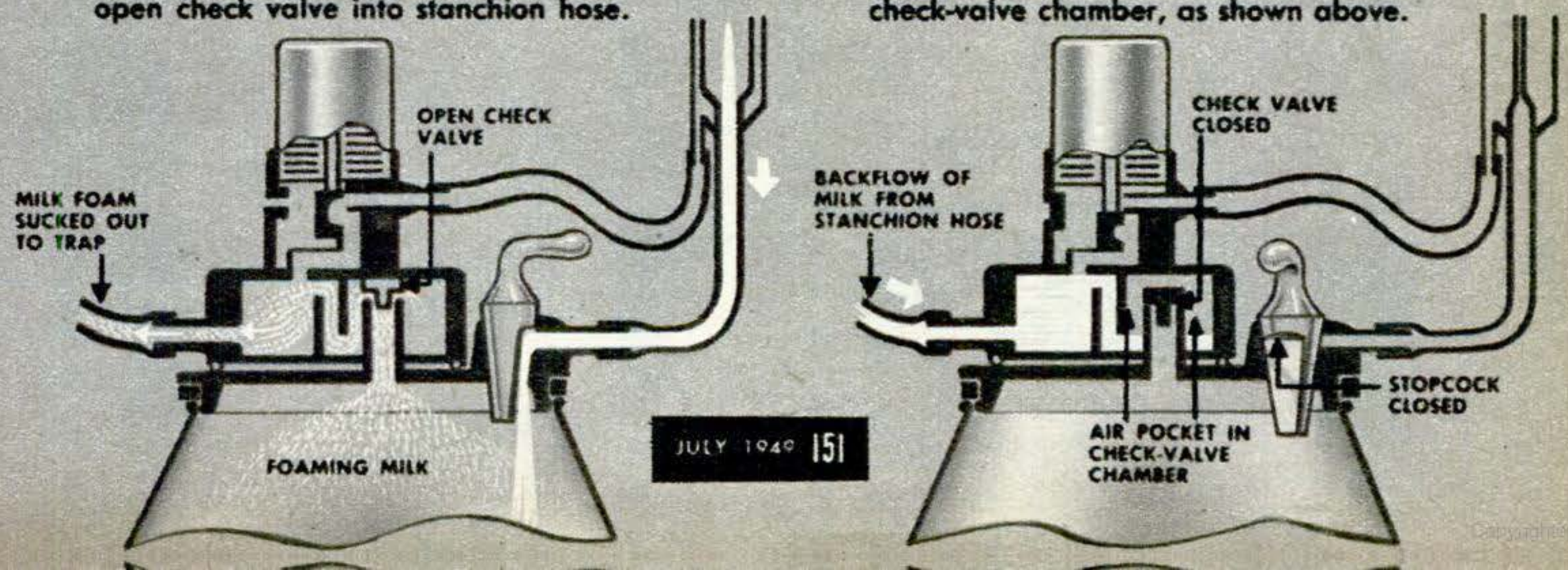
During pressure phase, air admitted through pulsation hose squeezes shut teat-cup milk passage.

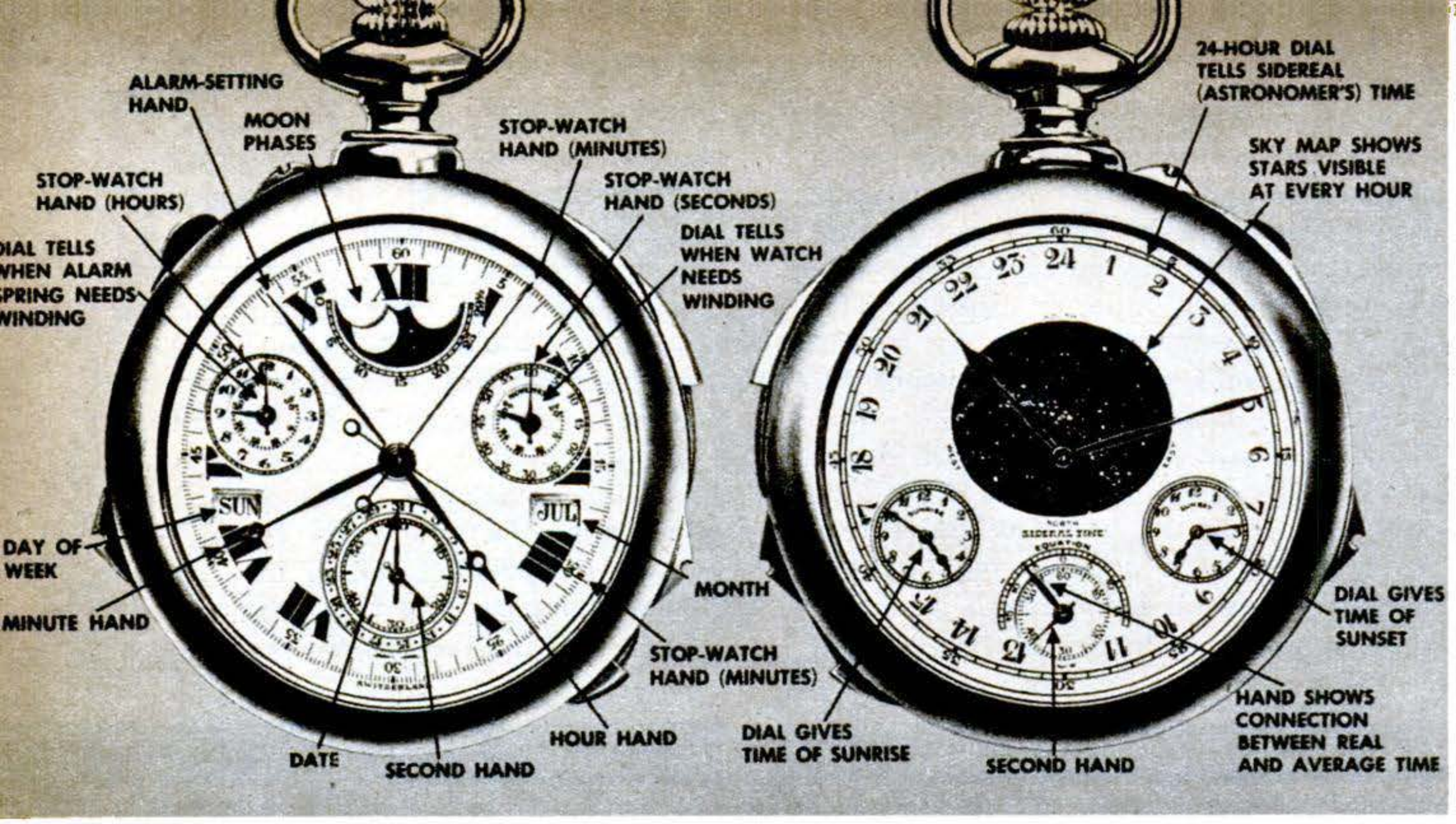
During relaxation phase, vacuum withdraws air from teat cup, opening passage for milk flow.

THE NEW MACHINE PREVENTS CONTAMINATION

Another source of possible contamination is foaming milk within the pail that might lodge in the machine. Here is shown how it escapes through open check valve into stanchion hose.

When machine is shut off, there is danger of backflow from stanchion hose reaching pail through check valve. This is prevented by air pocket in check-valve chamber, as shown above.





Two-Faced, $30,000 Watch Most Complicated in World

THE world's most complicated watch now rests in the pocket of some rich American — identity a secret. For his $30,000 he has a watch that tells almost everything about stars, seasons, dates, and time.

This expensive gadget has two faces. One face (above, right) tells sidereal time (astronomer's star time, about four minutes faster than ordinary sun time), and gives the equation linking real time (which varies) to average time. Two other dials mark the moments of sunrise and sunset, while a center oval shows the constellations visible at every hour of the night.

The other side (above, left) has chronograph and center second hands, which indicate fifths of a second. It has an alarm clock and a calendar that shows days, months, years, leap years, and moon phases. It also chimes hours, quarter-hours, and minutes.

Watchmakers in Geneva, Switzerland, required five years to make the timepiece. Only one more complex watch was ever made — and it was stolen in 1942 and is still missing.

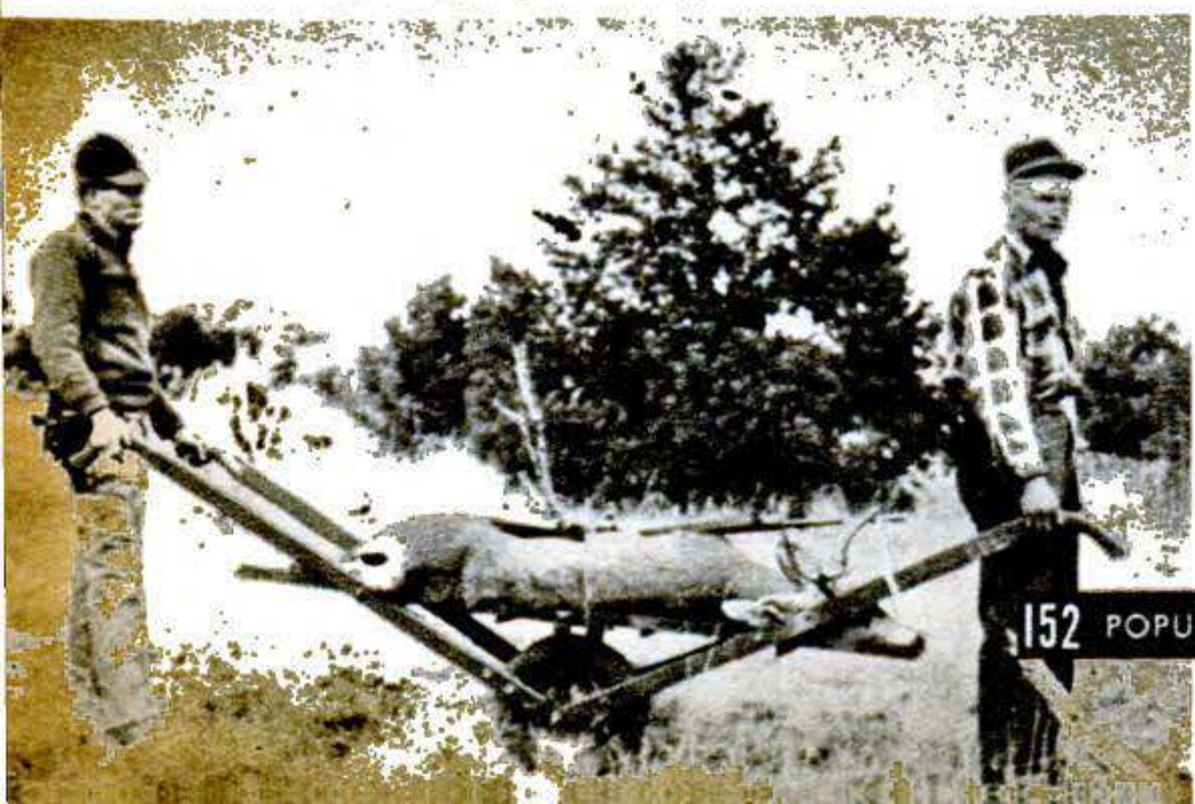
Plow-Handle Rig Totes Game

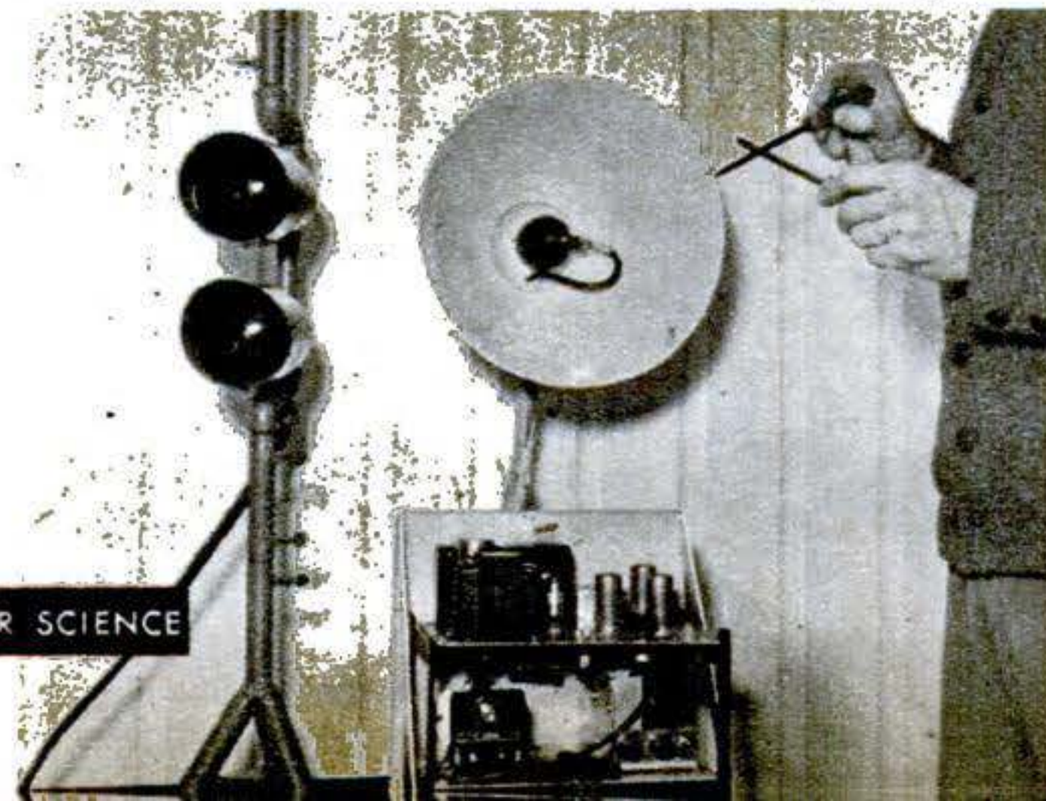
HERE'S an idea to ease the burden of those hunters expert and lucky enough to have anything to take back to the car at the end of a day's expedition. The simple carrier below rides over rough country on one pneumatic-tired wheel. It has a bed, 14 in. by 72 in., on a frame made from four plow handles. Four cross braces and two axle braces keep it rigid. For transportation in a car, the carrier can be unbolted and the bed folded in the middle. Walter L. Parker, of Albuquerque, N. M., made it.

"Ear" for Siren Stops Cars

FIRE engines and ambulances can get a clear path through traffic, thanks to a new device that turns stop lights red for other vehicles. It is an "ear" that listens for sirens. When its microphone picks up a high-pitched wail, relays turn traffic lights red — and they stay red until the siren has gone by. The ear pays no attention to the noise from racing motors.

Invented by Carl Glock, of Los Angeles, the device is shown below being triggered by the squeak of two nails rubbed together.





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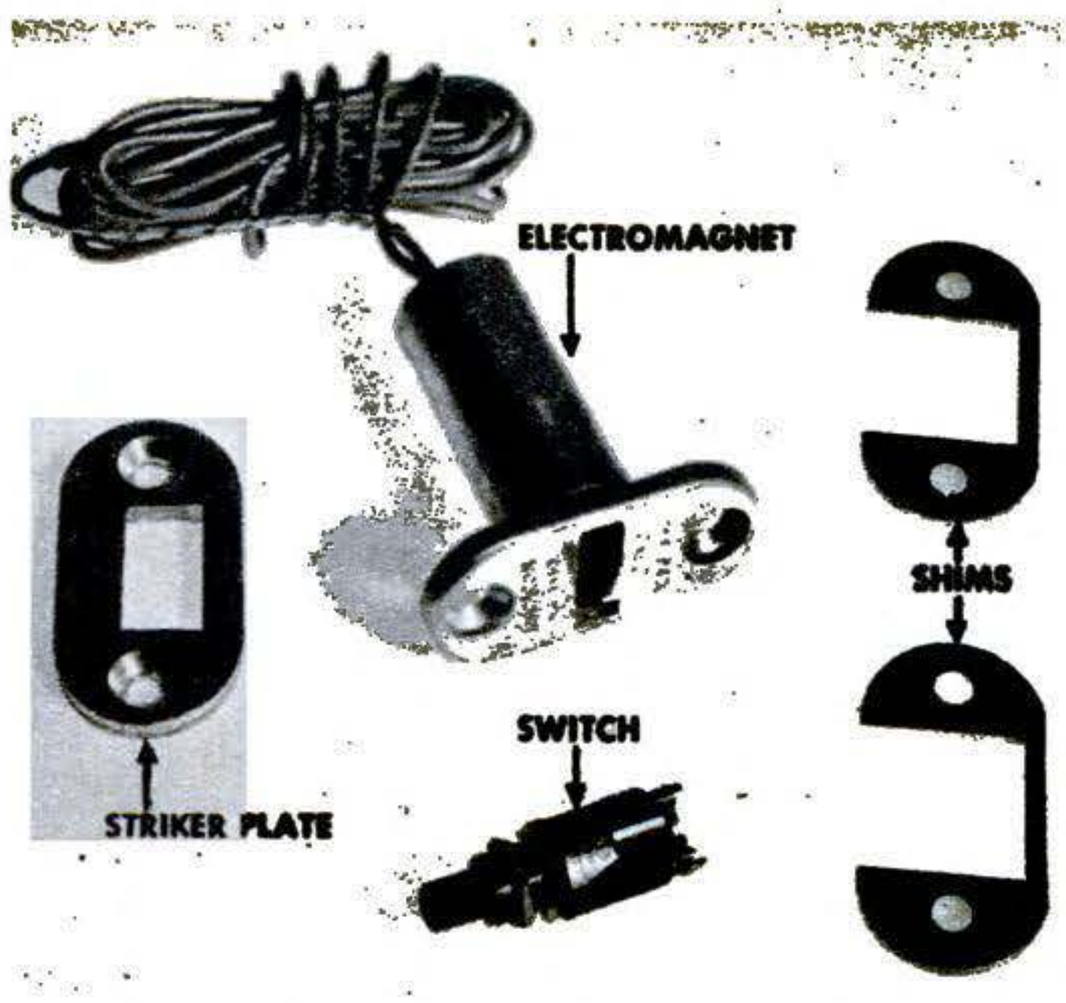

Ignition Locks the Rear Doors

DESIGNED to safeguard children in a moving car, this lock holds the doors shut as soon as you turn on the ignition. A special switch lets a door be opened with the motor on.

A striker plate on the door is offset in relation to the electromagnetic latch unit, located in the door posts. While the door remains closed, the plate holds back the latch. But if you start to open the door, the energized electromagnet thrusts the latch into the plate. The look is made by Magicon Enterprises, Oakland, Calif.

Trailer Roof Lifts or Folds

ON THE road, this trailer looks like a low, streamlined sportsman's model, but when it's parked it can be opened into the house-type unit above. Hinging half the roof allows it to be lifted into the position shown. As the roof is lifted, part of the floor drops down to provide up to 6′ 3″ headroom over part of the floor area. The Wee Zim®, made by Zimmer Boat and Trailer Co., Detroit, has an overall length of 15′ 8¾″ and is 80½″ wide. It weighs 2,000 lb., with 180 lb. on the hitch. There is ample sleeping room for four.

Youngsters Sleep as You Drive

CHILDREN up to six years old have a comfortable place to sleep and play if you install a Kiddie-Bunk® in the back of your car. Made of heavy duck on a hardwood frame, it sets up like a card table, covering the rear seat and reaching to the back of the front one. Short rear legs fit into a saddle bar that protects the rear cushion. The device folds for storage in the trunk. Koneta Products, Wapokoneta, Ohio, sells it for about $15.

Fights Under-Hood Fires

MOUNTED on the engine side of the firewall, the black, metal-cased extinguisher shown above automatically releases a fire-smothering gas when under-the-hood temperature goes over 255°. A glass grenade containing the fire-fighting fluid is automatically shattered when the trigger temerature is reached. The grenade may also be lifted out for manual use. Red Comet, Inc., Littleton, Colo., sells the device for about $11.

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Horace roared, shook his shaggy head, and leaped from the cage to disappear into the dark underbrush.

Gus Has a Wild Night

By Martin Bunn

GUS WILSON guided his car along the bumpy dirt road. Beside him dozed Ez Zacharias. It was nearly midnight. They had seen a boxing card in the city, and Gus was driving Ez home. He lives just outside of town, and the side road was a short cut.

High in the summer sky, a big moon coasted along, overtaking a stray wisp of cloud from time to time. Down in the bottoms, ribbons of mist hung close to the dark earth. The road twisted sharply up a steep grade and Gus drove slowly until he topped the rise. Then he kicked on the brakes.

"Hey, what goes?" he exclaimed. "There's a light in the old Coster house."

"City feller living there," Ez answered, stirring himself fully awake. "*I* wouldn't."

"Why not?" Gus asked.

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"Because it's haunted, that's why," Ez said flatly. "Been ghosts around there ever since old man Coster chopped his wife's head off near sixty years ago."

Gus laughed.

"All right—laugh," Ez growled, "but I've seen 'em—pale, blue, glowing things."

Gus let in the clutch. As the car moved forward, red lights showed dimly through the mist in the hollow below.

"There's a car parked down there," Gus pointed out. "I wonder . . ."

He was cut off by the blast of a horn and glaring headlights as a truck swept up behind them and clattered past down the hill. In a moment a resounding crash sounded from the hollow. Gus coasted his car down the hill and braked behind the truck. He and Ez saw that it had crashed into the rear of another truck, parked partly off the narrow road.

The body of the one that had been hit was an iron-barred cage occupied by a large and annoyed lion. The other was loaded with canvas and poles. On both trucks were emblazoned the words: Gay's Gayest Shows. Gus recalled that a small carnival had been playing nearby towns.

The two men who climbed down from the trucks seemed neither surprised nor upset by the accident. The driver of the cage truck was a tallish man with a waxed mustache. He wore a faded blue uniform lavishly decorated with tarnished gold braid. The other driver was a bandy-legged little fellow.

"Thought you'd be coming along, Tom," the uniformed one said mildly. "Something's

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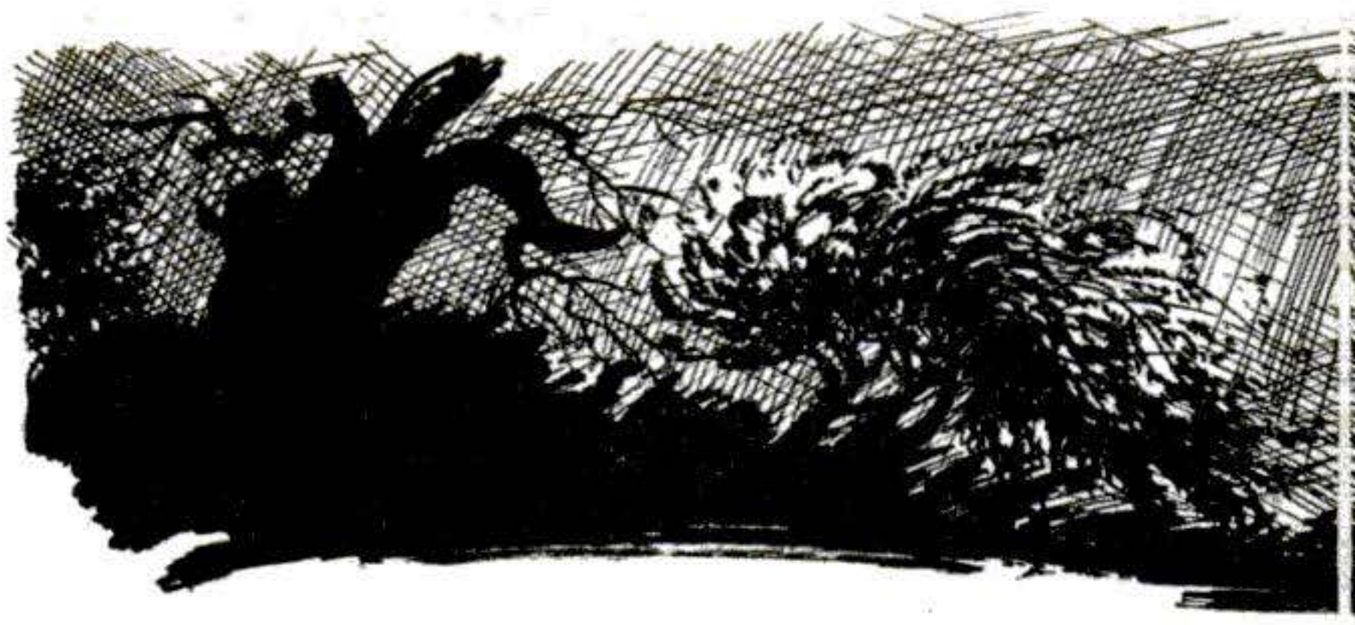
busted on my truck. The engine runs but the truck won't move. Thought maybe you could tow me to a garage—and now you've gone and hit my rear end and got old Horace upset."

"Wasn't my fault, Joe," Tom replied. "Brakes ain't been workin' any too good here lately. Old Gay's too tight to get 'em fixed. And my emergency just wouldn't hold."

"Ain't much harm done—I guess," Joe said. "Let's pull 'em apart and see."



Horace Takes a Powder

Tom climbed into his truck, shifted into reverse, and stepped on the gas. There was a grinding squeal as the trucks pulled apart, and then the harsh rending of metal. Tom's truck lurched backward, leaving the rear of the cage a tangle of twisted bars.

Horace roared, shook his shaggy head, and leaped from the cage to disappear into the dark underbrush.

"Horace!" Joe yelled. "Horace! You come back here right now." Joe looked reproachfully at Tom. "Now you've done it."

Gus and Ez had gotten out of the car to look at the crashed trucks. When Horace took off, they edged back toward it.

"Now what?" Gus asked them.

"I dunno," Joe said. "I'm a lion tamer and he's a canvasman. Neither of us knows about fixin' trucks."

"I might be able to help," Gus told them. "I run a garage in the next town. I'd take a look at your trucks, but I don't like to be standing around with that lion running loose."

"Oh, you don't need to be afraid of Horace," Joe said. "He's just an old pet."

"I'll stick to standard-size cats," Gus put in.

"Don't worry about Horace," Joe went on. "Nearly all his teeth fell out long ago."

"Who wants to be gummed by a lion?" Ez asked.

"He won't bother you," Joe insisted. "Anyway, he won't come back for a half hour. He never does."

"You mean he's escaped before?" Gus asked.

"Sure, lots of times," Joe said.

"Anyway," Tom interrupted, "how about fixin' up these trucks?"

"All right," Gus agreed reluctantly. "I'll have a look."

He got in the cage truck, flipped the ignition key, and stepped on the starter. The engine didn't fire. He tried again, giving it a little choke. Finally the engine caught, but it ran raggedly.

Leaving the engine running, Gus got out and raised the hood. A faint blue glow danced around the spark-plug wires and terminals.

"Look at that!" Ez exclaimed, jumping back. "Pale blue ghost lights, like I told you. This whole place is haunted."

"What are you talking about?" Gus snapped. "That's nothing but a corona—electrical leakage of high voltage." He turned to Joe. "You need new spark-plug leads. That's why it's hard to start here in the fog and damp."

Back in the cab, Gus eased the truck into first. But when he let up the clutch, the truck didn't move. He cut the switch and got out.

"It could be any one of several things," Gus said. "Might be the clutch, transmission, universal, drive shaft, or rear end. At any rate, it's a job for a shop. I can check the universal right here." He took the flashlight, walked around to the side of the truck and crawled under it. In a minute he pulled himself out, brushing grass and leaves from his trousers.

"Universal's broken," he told the group. "Have to put in a new one."

"Old man Gay'll flip his lid about this," Joe said.

"And you've got brake trouble?" Gus asked Tom.

"That's right," the man said. "They been gradually getting worse and when I came down this hill here, they just plain wouldn't hold."

Pinhole Trouble

Gus slipped into the driver's seat and stepped on the brake pedal. There was no resistance to the pressure of his foot.

"Got a wrench?" he asked Tom as he climbed from the cab.

Tom rooted around back of the driver's seat and produced an adjustable wrench. Meanwhile Gus had raised the hood. He took the wrench and, while Ez held the light, unscrewed the plug on the brake system's

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master cylinder. Then he peered within.

"No wonder your brakes wouldn't hold," Gus said. "You've lost just about all the fluid in the system."

Gus took the flashlight and inspected the lines and hoses leading to each brake. The two rear ones and the left front brake seemed okay. But when he came to the right front wheel, he noticed a small amount of the missing fluid on the line. Closer inspection revealed a pin-sized hole in the hose through which the fluid had oozed.

"There's a pinhole in that hydraulic line," Gus said. "Have to replace the hose and add fluid to the system."

"That's funny," Tom said. "When I started out the brakes weren't perfect but they at least worked."

"Nothing funny about that," Gus said. "The leak's so small that it didn't cause your brakes to fail immediately. The leak probably began just about the time you started this trip. Each time you hit the brakes you lost some fluid. By the time you got here and went rolling down that hill, you just didn't have enough fluid to stop the truck."

"Well," said the lion tamer, "we got to get these trucks fixed, but how we gonna get 'em to your shop?"

"My idea," Gus answered, "is for you to catch Horace and then I'll drive you into town. I'll send a tow car out in the morning."

"That won't do," Joe said. "I'm afraid we're gonna be late now. We're due to set up the show in Middletown tomorrow morning. We open at three in the afternoon."

"Can't you go get your tow car now?" Tom asked.

"That wouldn't save much time," Joe said. "He'd have to go get the car and then make two trips to get both trucks in."

"This is bad," Tom said. "That canvas on my truck is part of the main tent."

"That's gonna be a mighty funny-looking show," Ez put in, "with a big chunk of the main tent missing. Plenty of fresh air, though," he added.

"That's one of those things Old Man Gay won't think is funny," Joe said.

"Ever hear the story of the lame man and the blind man?" Gus grinned. "You two are in pretty much the same situation. Anyway, here's how we'll get your trucks to the shop. Tom's truck has power, but no brakes. Joe's truck has brakes, but no power. Tom tows Joe and Joe's brakes stop both trucks."

"That's what I call real smart," Joe smiled.

"But you're going to have to drive slowly and use a lot of caution," Gus said. "Not that I'd recommend this if it weren't an emergency. You, Joe, will be in the rear. You'll have the brakes but you won't be able to see so well."

"Suppose I sound a long blast on the horn when I need brakes," Tom suggested.

"That's a good idea," Gus agreed.

"And keep the tow line tight," Tom added. "Especially goin' down hills. I don't want that line to snap and let me go."

"Okay," said Gus, "now get going. I'll lead you to the garage. First thing in the morning we'll put two men on the job, and you'll be rolling by 10:30."

Who's Scared?

As the two men busied themselves hooking up the tow line, Gus got into his car and slammed the door. But reaching for the ignition key, he felt hot breath on his face. Turning, he looked squarely into the whiskered, yawning face of Horace, poked into the opposite window.

"Horace!" Joe yelled. "You come here right now." The lion crouched and Joe slipped a collar on him.

Ez, who had watched the lion's capture from a nearby tree, slid down and slipped into the seat beside Gus.

"Say," he asked, "what's the matter with you?"

"I . . . I . . ." Gus began weakly.

"Haw, haw," Ez laughed. "Gus Wilson afraid of a toothless old lion."

"Not as scared as you," Gus retorted. "And I can prove it."

"Yeah? How?"

Gus got out of the car and walked to the tree Ez had climbed. In a minute he was back waving something dark and floppy.

"We'll leave it to the boys around the garage when I show 'em this," Gus chuckled. "Maybe I was scared—but not enough to leave the seat of my pants up a tree." END

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Solder Smooths Auto-Body

By E. F. Lindsley

BUMPING out and refinishing will take care of many simple dents and nicks in the body and fenders of an automobile. But often you will encounter damage that demands filling and shaping with solder, perhaps in addition to straightening.

Unless the damage is extensive, both kinds of repairs can easily be handled by a careful amateur. Tips on the straightening type of job were given in "Bump 'Em Out Yourself" (PS, April '48, p. 168).

You must resort to solder in several fairly common situations. Dents inaccessible from the inside are most easily repaired with solder. Also, solder is a "must" when you want to hide weld beads in conspicuous spots, when you are repairing metal stretched too badly to be blended out, or if the metal has been filed so thin in previous repairs that it can't be worked.

But before deciding that solder fits your case, give some consideration to the place where it's to be used. Always try to avoid placing it in large quantities on an extensive flat surface, a fender skirt for instance. Since such parts generally are subjected to considerable flexing and vibration, a thick slab of rigid solder may eventually loosen. Areas with ample curvature to resist vibration are not so critical.

Tools and materials required for a body-soldering job in your back yard are not particularly extensive. Ordinary bar solder can be used if it has a reasonable tin content.

You'll need a wood paddle to smooth off the solder. Such paddles usually are made of a hard, close-grained wood. To prevent sticking while in use, the wood must be well soaked in paddle oil. This oil is available at an auto-body supply shop. If desired, tallow can be used in place of the oil.

Body putty also may come in handy. In fact, there are times when you may find it possible to take care of some body and fender repairs entirely with this rather than solder.

How to Do the Job

To see how an experienced body repairman works, let's tackle an actual soldering job and follow it through step by step. The example chosen, and illustrated in the drawings below, was a very sharp gouge in the upper front surface of a rear fender. This dent was inaccessible from inside and the metal had been stretched to the point where blending would have left a noticeable hump.

Hammer, bumping dolly, and file are used first to restore the general shape of the fender as well as possible. Also, the surrounding lacquered surface must be cut back for a distance of several inches with wet sandpaper to leave a bright, clean working area.

A sharp, deep dent in front part of rear fender is kind of damage requiring solder. For how it is repaired, see drawings at right.

Heated dent is cleaned with steel wool dipped in soldering fluid. Paint is first sanded off. Sheet asbestos protects finish.

Good tinning is essential. A thin tinning coat is first flowed on and then scoured with steel wool to provide an anchor for the solder.

Softened end of solder bar is now jabbed into the dent at several points, leaving enough blobs of solder to fill the dent.

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Dents

Car scars that can't be fixed with a hammer will vanish under solder. Here's how to do it yourself.

Before starting the actual soldering, cut a sheet of ordinary asbestos paper to match the curve of the fender-body juncture. Tape this to the side of the body. Remove the wheel and protect the brake drum and adjoining parts with cardboard to guard against accidental splashing with acid flux and solder.

Once you have begun the soldering process, you should complete the job as rapidly as possible, not allowing the metal to cool between steps. Therefore, it pays to have all necessary materials within easy reach.

A good tinning job is the most vital step in successful body soldering. Haphazard tinning may cause solder to loosen. Using a gas or gasoline torch, apply heat over the entire work area. If the torch has a relatively small and concentrated flame, be sure to move it about constantly to get even heating. When the metal has been well warmed, grip a wad of medium-cut steel wool in a pair of pliers and dip it into a jar of acid-type soldering fluid.

Continuing to apply heat, thoroughly scour the work area with the flux-soaked wool. Repeat this operation until no traces of paint, rust, or welding scale remain.

Still keeping the torch on the work area, hold a bar of solder near the flame so the fender and solder reach soldering temperature about the same time. Smear the fluxed surface with ample solder and then use the steel wool and pliers to spread it in a smooth, even tinning coat. Dip the wool in the flux as required. Because of the cooling action of the fluid, it will probably be necessary to apply more heat to hold the solder in a liquid state.

Consider the tinning job satisfactory only when the smallest area is completely wetted with solder. Remember this is the foundation upon which you must build.

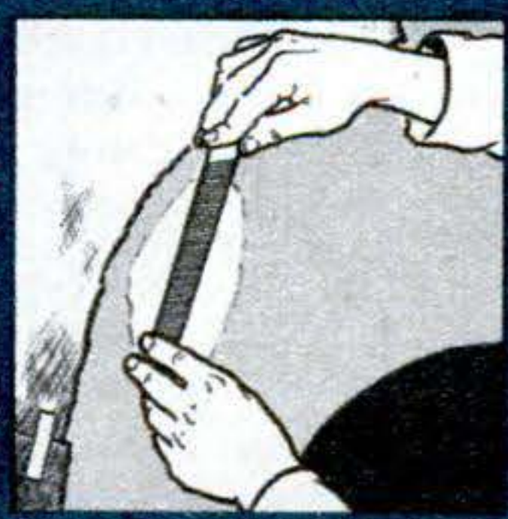
Keep Heat on the Work Area

And don't put down the torch. Keep it directed on the dented area and again heat the bar of solder. This time heat the bar for several inches until it has assumed a mushy condition. Just before the solder is ready to flow, jab the softened end of the bar vigorously into the tinned area at several points, leaving behind ample metal to fill the depression.

Manipulate the torch as required to keep the solder soft, but be careful to prevent it from melting and flowing off. At this point, the wood paddle is brought into use.

After the paddle has been covered with oil, use forceful, trowel-like strokes to level the solder lumps to the approximate original contours of the fender. Do not overdo the paddling, but be sure the solder is forced into solid adhesion with all the spots it touches. Remember it is easier to work down

Kept mushy by the flame, the solder is then leveled off to the contour desired. A wood paddle soaked in oil is used for this job.



When cool, soldered area is dressed off with coarse file or abrasive disk. As final step, the surface is cleaned up with fine file.

As first step in applying a new finish, area is washed with soda to neutralize flux. It is also gone over with pre-priming cleanser.

Small blemishes are filled with body putty after priming coat has been smoothed by wet-sanding. Finish in usual manner.

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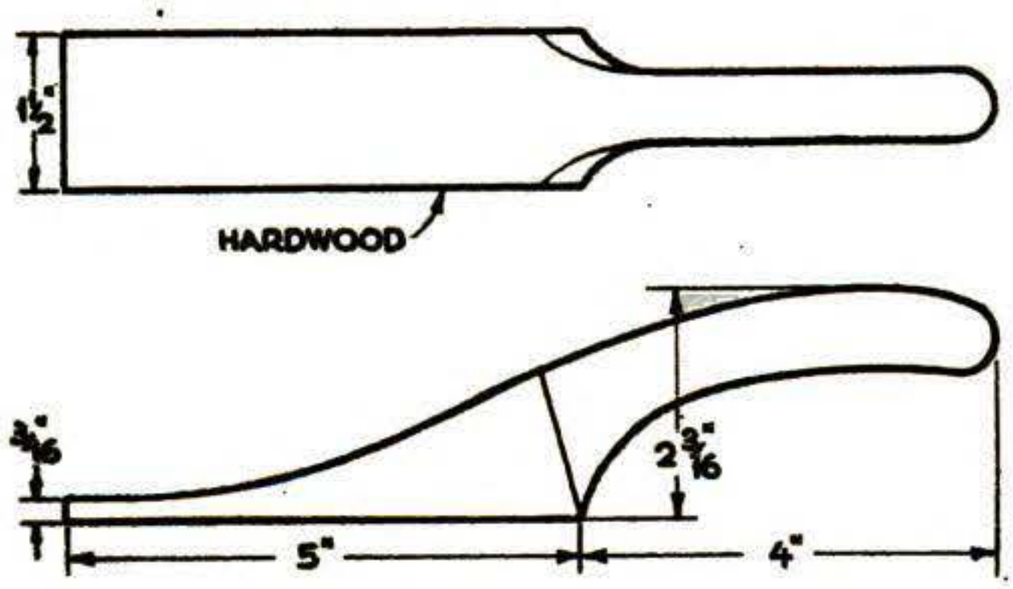
Tools and materials used in a body soldering job include these. A flexible shaft and abrasive disks are convenient but not essential.



Wood paddle for smoothing down the softened solder can be made to these dimensions. Shape it from hardwood. It must be oiled before use.

a high spot with the paddle than to file it down later.

These steps conclude the actual soldering. Before going further, it is best to give the solder plenty of time to cool completely. Use your waiting time to wipe up any acid and spattered solder.

Actual finishing of such a filled area must be done with extreme care. Otherwise, you may leave ridges and flat spots that will stand out in the completed job.

Rock the File to Prevent Flat Spots

When roughing down the solder, you can do the quickest job with a flexible shaft and a coarse abrasive disk with a flexible back. But in a home job, where time is no great factor, you can use an ordinary coarse file. Stop occasionally and clean the solder from the file. When you have approached the final contours, switch to a mill-cut file to smooth off any deep file scratches that you have left. Remember to rock the file along the curved surface to avoid leaving any flat spots.

Before the area is primed, it must be neutralized to remove any traces of the acid soldering flux. Ordinary baking soda in water will accomplish this. Follow by wiping with the commercial cleansing agent recommended by the manufacturer of the primer you have chosen. This step is important.

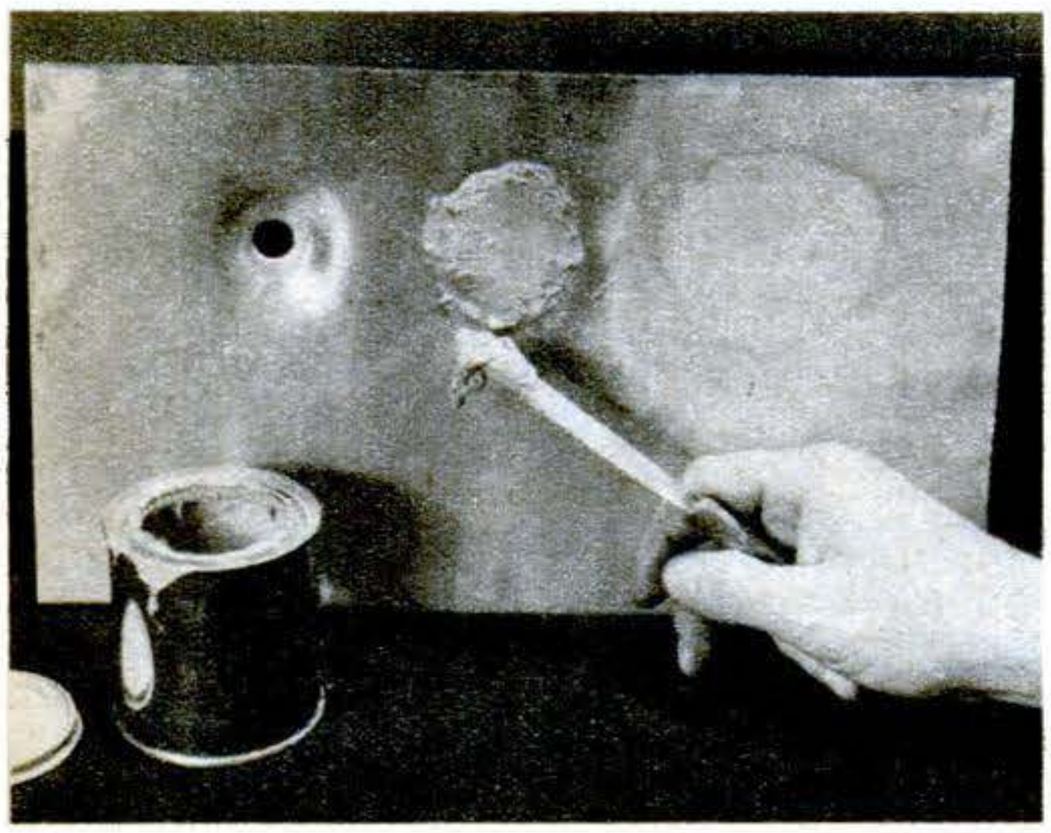
From here on, the repair job follows standard refinishing technique. It probably will be best to repaint the entire fender or panel on which you have worked.

Remove the old wax and any oil with a commercial cleanser, sand down to bare metal, clean again, and mask any parts that will be in line with the overspray.

After spraying with primer-surfacer, fill any small imperfections or file marks with body putty. Apply with a scraping action of a stiff piece of cardboard. When the putty is hard, wet-sand the entire area and spray with a finish coat or two.

When the final coat has dried at least a day, go to work with rubbing compound. Follow this with wax. END

Powdered-Aluminum Paste Fills Dents in Cars



NEW powdered-aluminum products with a doughlike consistency are now being marketed as a substitute for solder in repairing damaged auto bodies and fenders.

These are applied cold with a spatula or similar tool, as seen at left. As the solvent evaporates, the metal hardens and can be filed or sanded smooth. The material is said to adhere well to a properly cleaned surface and to provide a good base for refinishing. Successive applications will build up thicknesses of as much as an inch. Reynolds Metals Company, Louisville, Ky., aided in developing the products.

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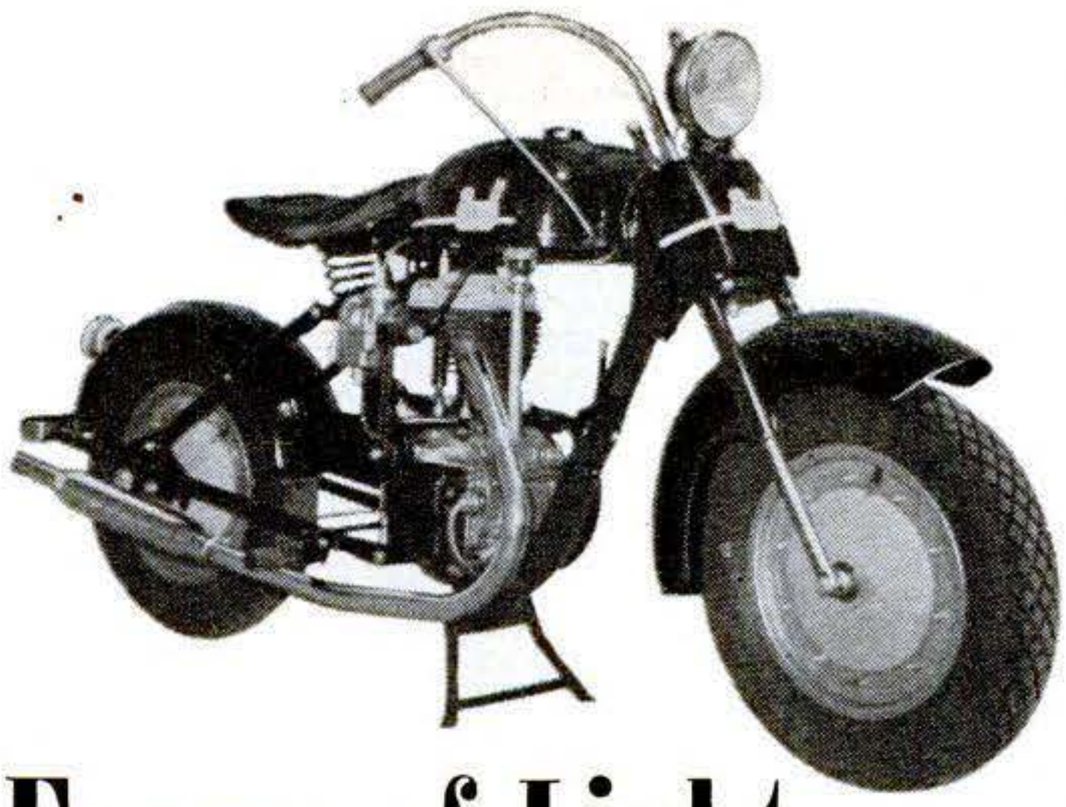
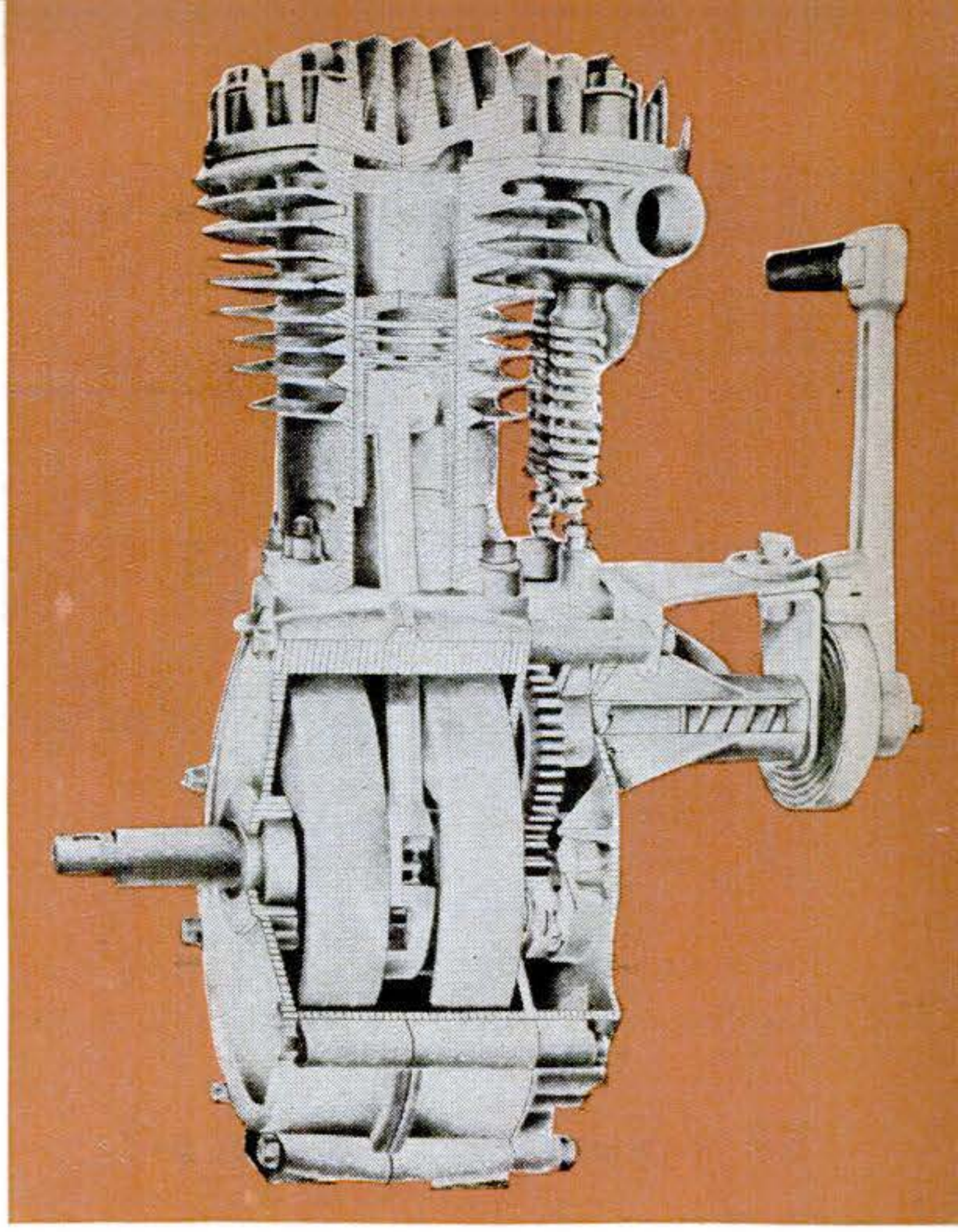


Frame of Light Motorcycle Carries Oil Supply



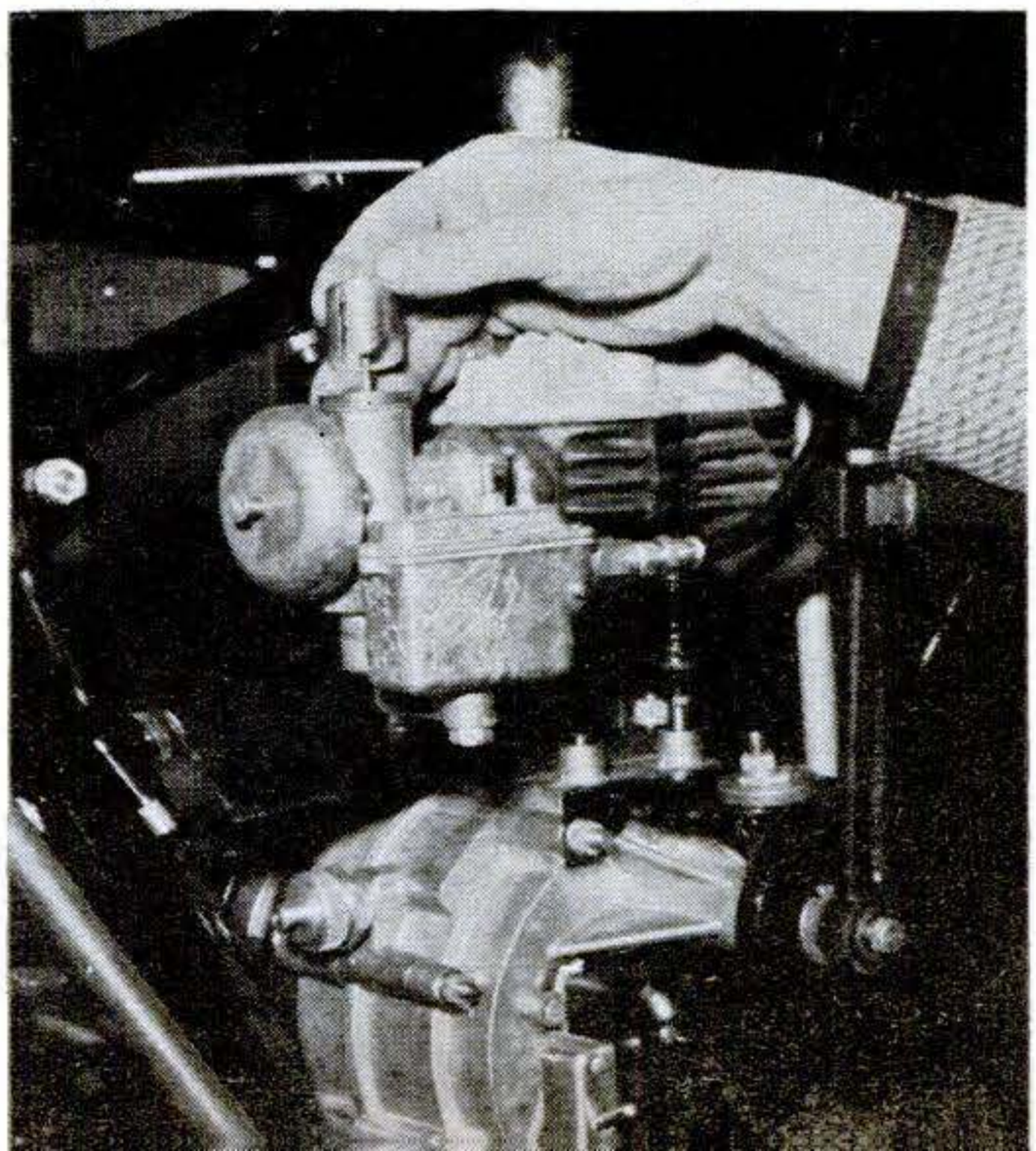
Four-cycle engine has double flywheel and aluminum piston. Kick starter is at right. Machine does 50 miles on a gallon of gasoline.

WEIGHING just short of 200 lb., this little motorcycle introduces several novel features. Foremost is the husky main frame. Made of 2″ steel tubing, it doubles as an oil tank of 6-pint capacity. This helps cool the oil and gives the machine a sturdy, clean appearance.

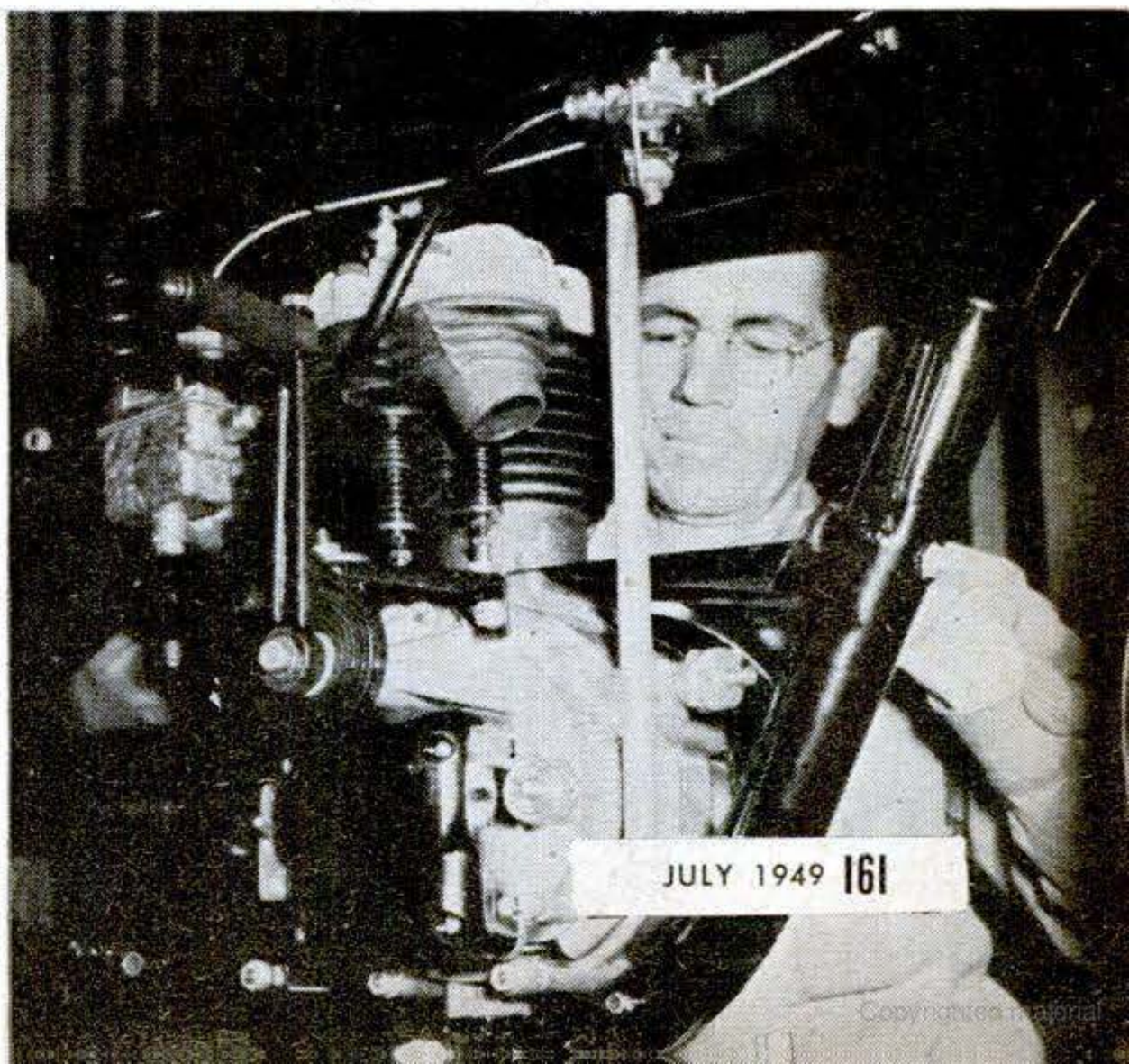
Developed by the Powell Manufacturing Company, Compton, Calif., to sell for about $250 f.o.b., the machine has a single-cylinder, 8-hp. L-head engine. With a weight-power ratio of 25 lb. per hp., the motorcycle has good acceleration. Top speed is more than 60 m.p.h., and it does an easy 45 for cruising. It has no gear shift.

The clutch operates automatically. To start, you merely open the throttle. To stop, you close the throttle and apply the internal-expanding brake. There's a telescopic front fork. Wheels are of die-cast aluminum and carry 4.00 by 12 tires. The seat is mounted on a single helical spring. A cam-actuated tightener simplifies chain adjustment.

Carburetor is designed for quick and positive choking to improve cold starting. Engine uses many standard automobile components.



Sturdy construction of the frame and engine is apparent here. Engine has a compression ratio of 5.8-to-1, piston displacement of 24 cu. in.



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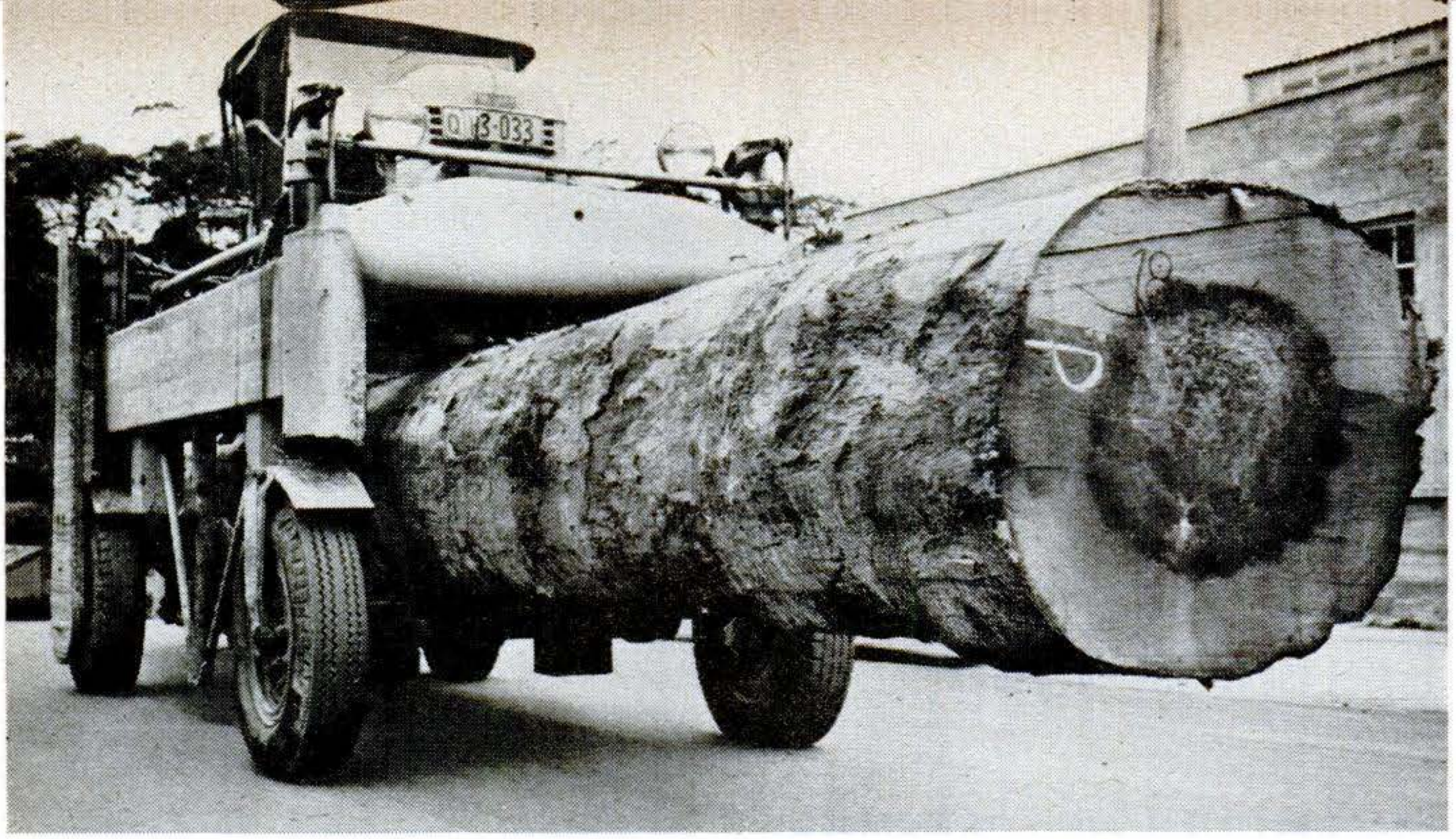
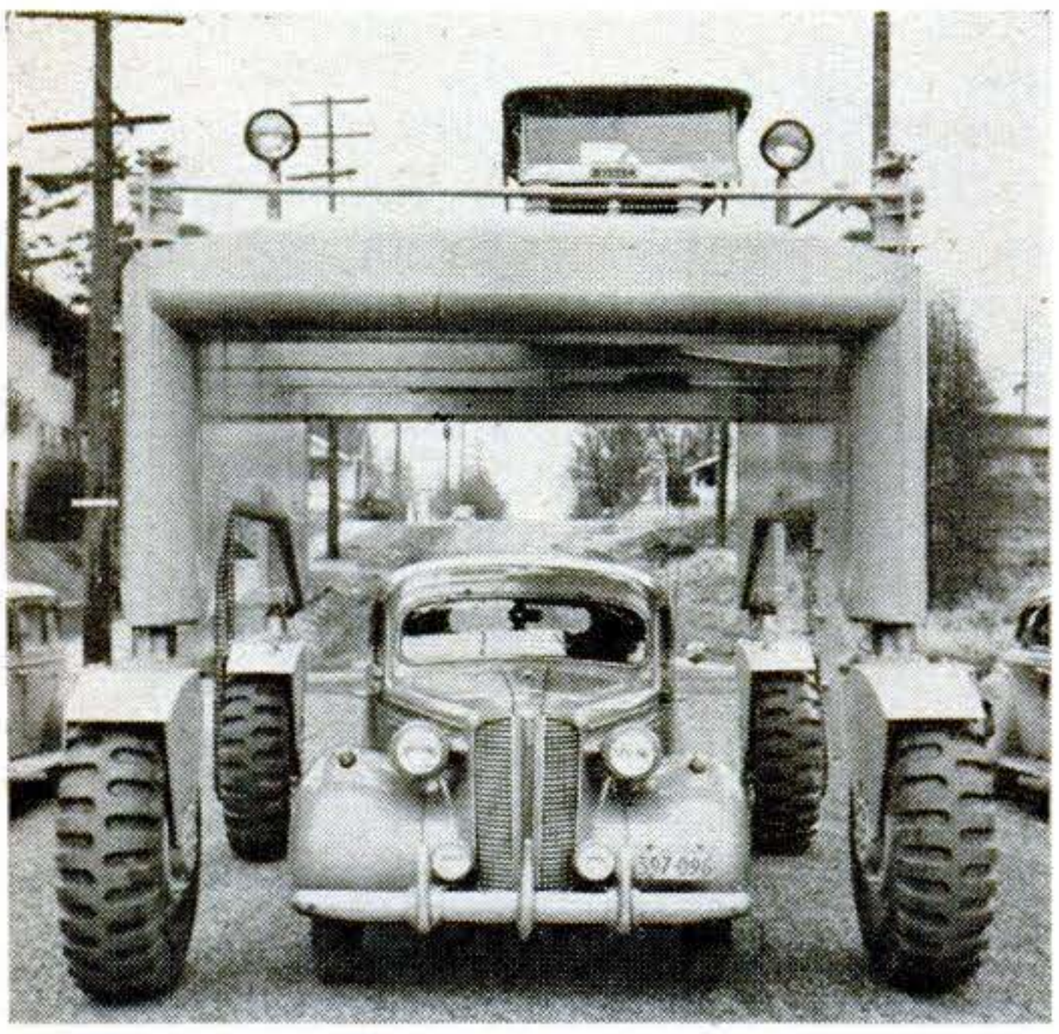


Hauling a king-sized log is a simple matter. Some straddle trucks handle a 30,000-lb. load.

Odd-Job Trucks Straddle Their Loads



Widest ever built by the Hyster Company, this truck is 11½′ across, 13′ high, and 16¼′ long.

IF YOU think a truck always carries its burden on its back, take a look at these vehicles. This kind, generally called a straddle truck, tucks the load under its belly and rolls away, either forward or backward, at speeds up to 55 m.p.h.

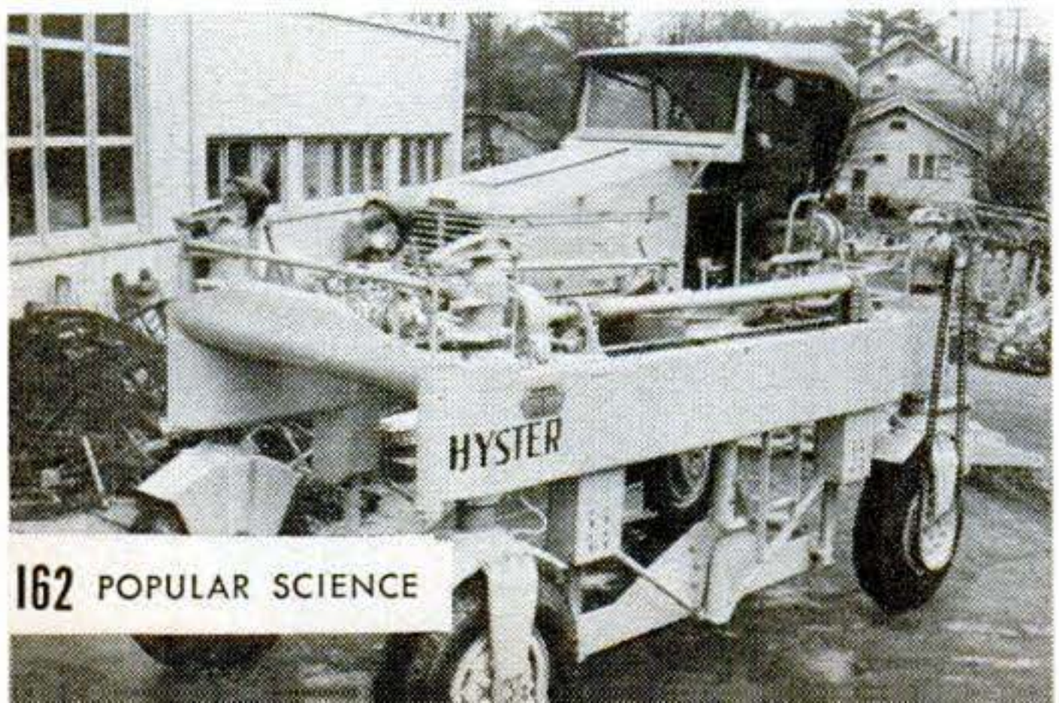
Materials handling around mills, docks, warehouses, and industrial plants is the biggest job done by straddle trucks. Long objects—timbers, girders, pipe, and the like—are their special meat.

Straddle trucks usually are equipped with load-carrying shoes, L-section lengthwise members that support either a carrying platform or the load itself. In some cases, slings are fitted instead of shoes.

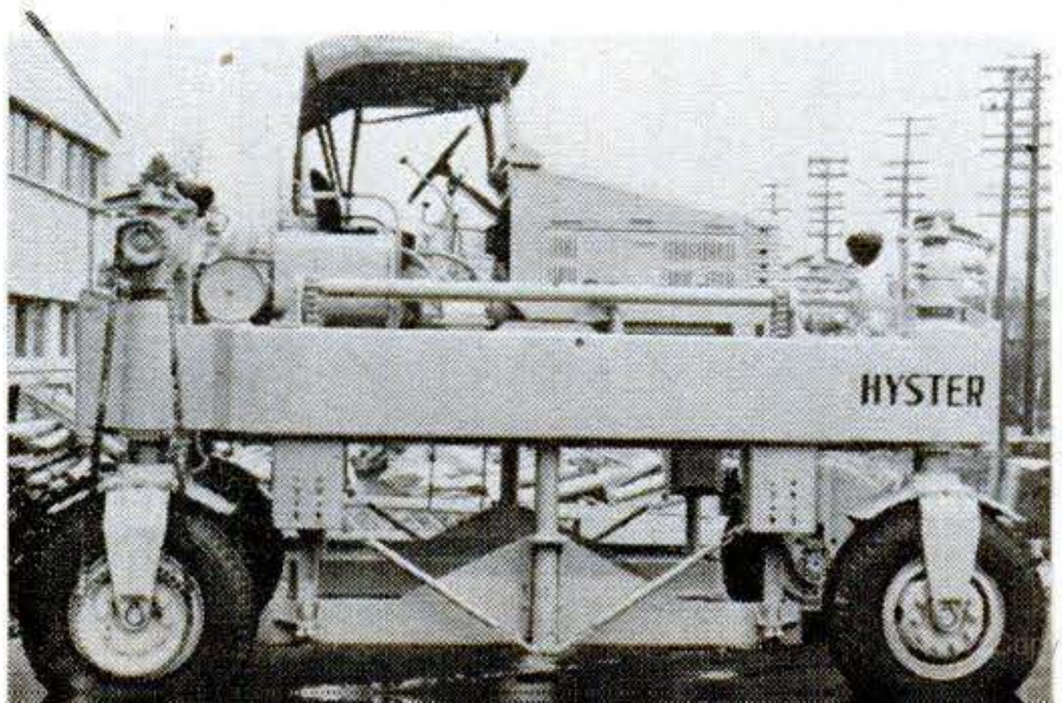
All these vehicles travel backward with the same facility that they go forward. Some have four speeds in each direction, others five. Maximum speed varies according to the designed use of the truck.

The vehicles shown here are products of the Hyster Company, Portland, Ore. Firms producing similar trucks include the Ross Carrier Co., Benton Harbor, Mich., and the Gerlinger Carrier Co., Dallas, Ore.

Two L-section shoes underneath carry the load in most cases. Engine raises and lowers shoes.



Chains drive rear wheels. Steering gear turns all four wheels, making short turns possible.



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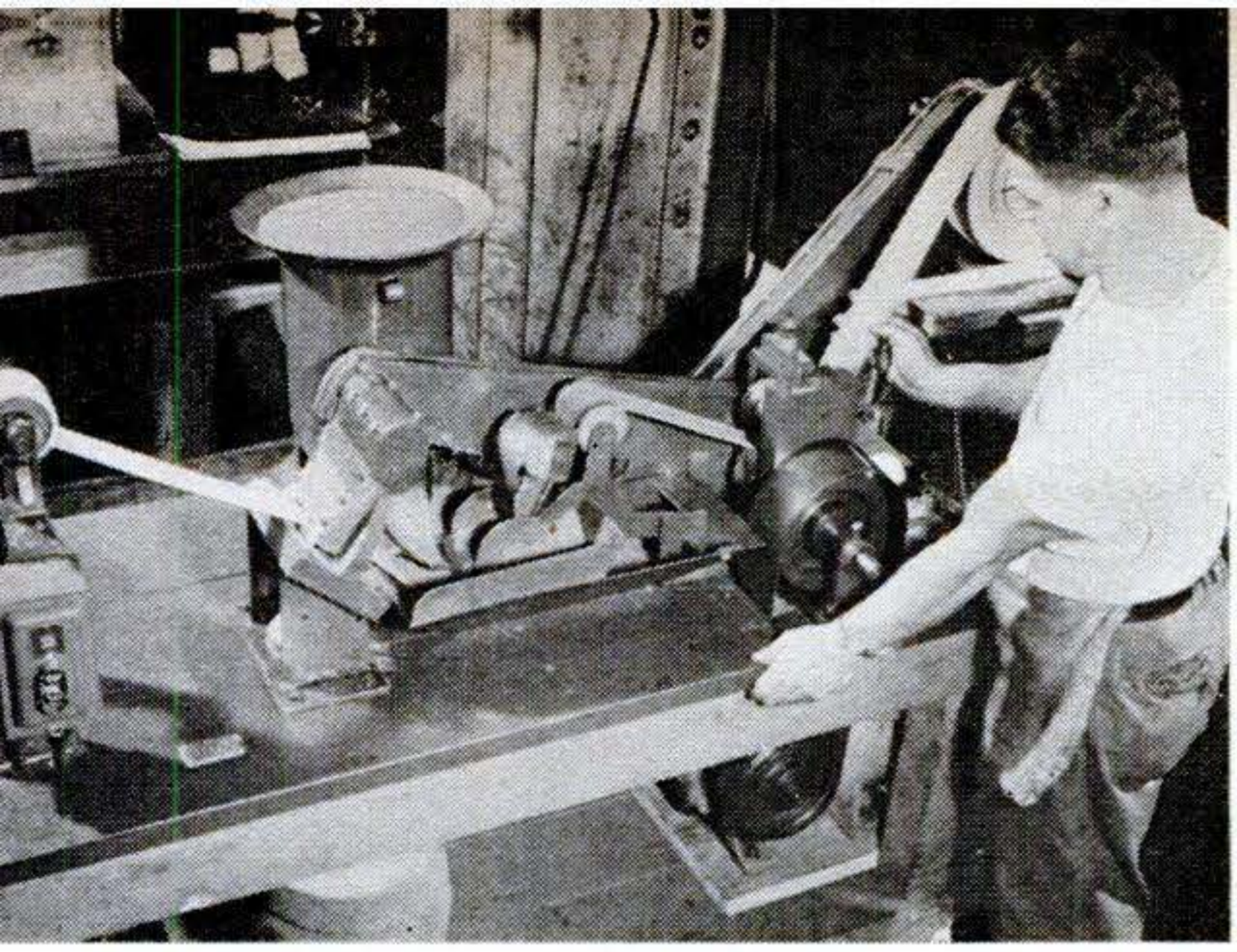
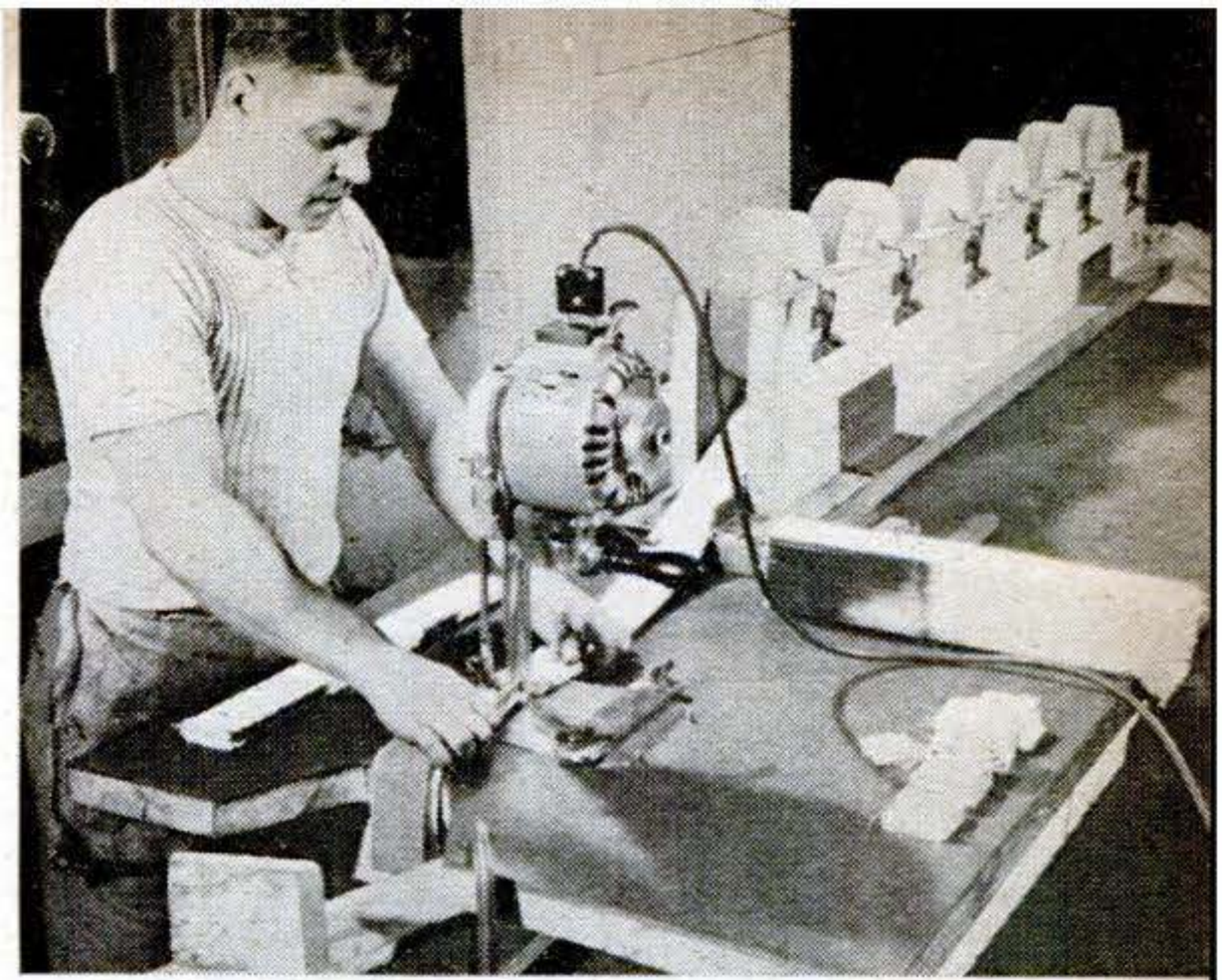
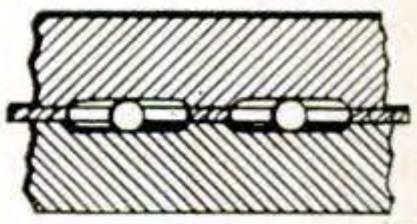


Adhesive tape is coated with a layer of tiny shot by this special machine. The tape passes between two rollers, pressing shot in firmly.



Shot-coated tape is cut to 2" lengths. Placed near ends of leaves, balls cut through tape to wear their own races, as in sketch below.

Studebaker Rides on Ball-Bearing Springs



TINY steel balls are now being used to reduce friction between the leaves of the transverse front springs on the Studebaker. Averaging about .026" in diameter, they are actually hardened peening shot.

Placed only near the tips of the major leaves, the little balls roll a short distance when the springs flex. For convenience in handling and application, the shot are pressed into the sticky surface of an adhesive cotton tape. Through use, the hardened balls wear races for themselves in the spring surfaces.

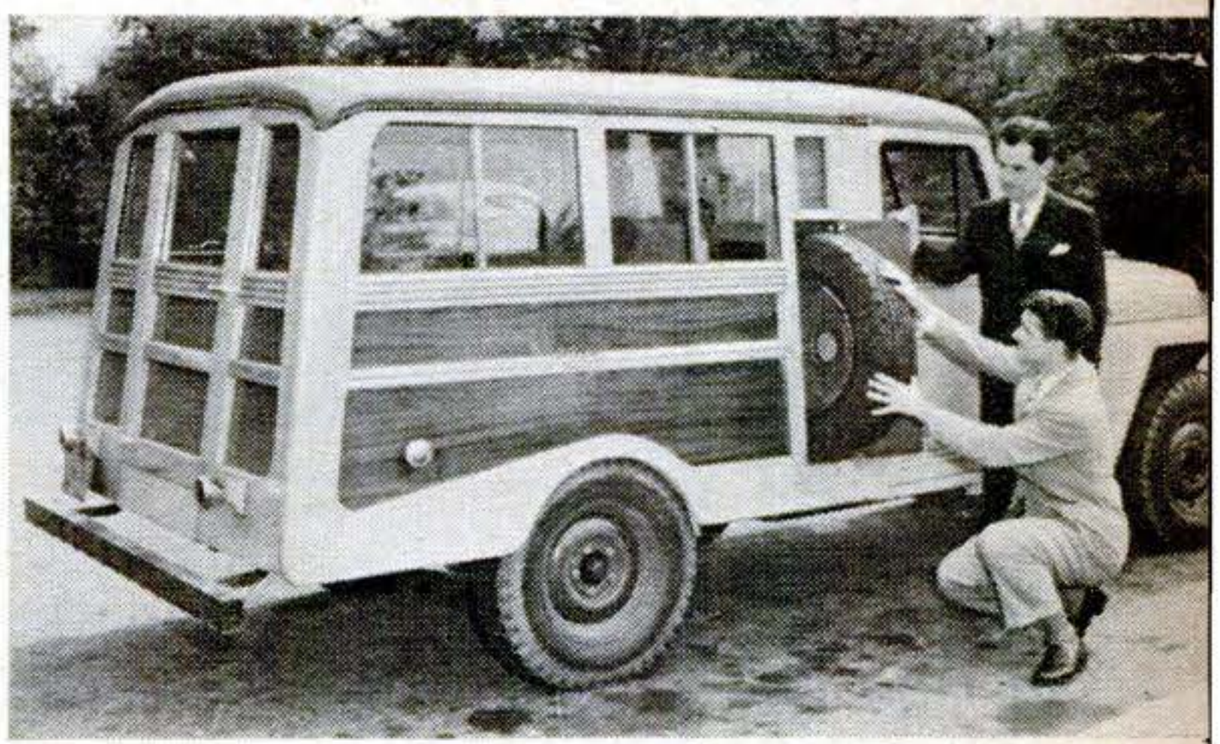
Accompanying photos show how the inserts are prepared and applied. Shot-coated patches of tape are placed on four leaves of the Champion® springs and on five on the Commander®. Cement keeps the patches in position during assembly.

Tape inserts are cemented to the major spring leaves about ¼" from tip. Assembled springs are protected by fabric and metal covers.

Car Seats Become Twin Beds

BUILT to the order of Lowell Thomas, Jr., for a trip through Iran, this station wagon combines the features of a trailer with the power of a four-wheel-drive truck. Thomas and his newscaster father are seen here checking the spare-tire compartment.

Features include bench-type seats that convert into twin beds, a built-in wire recorder, and a fold-down table. Canell Station Wagons, Jersey City, N. J., built the body on a Willys four-wheel-drive chassis.



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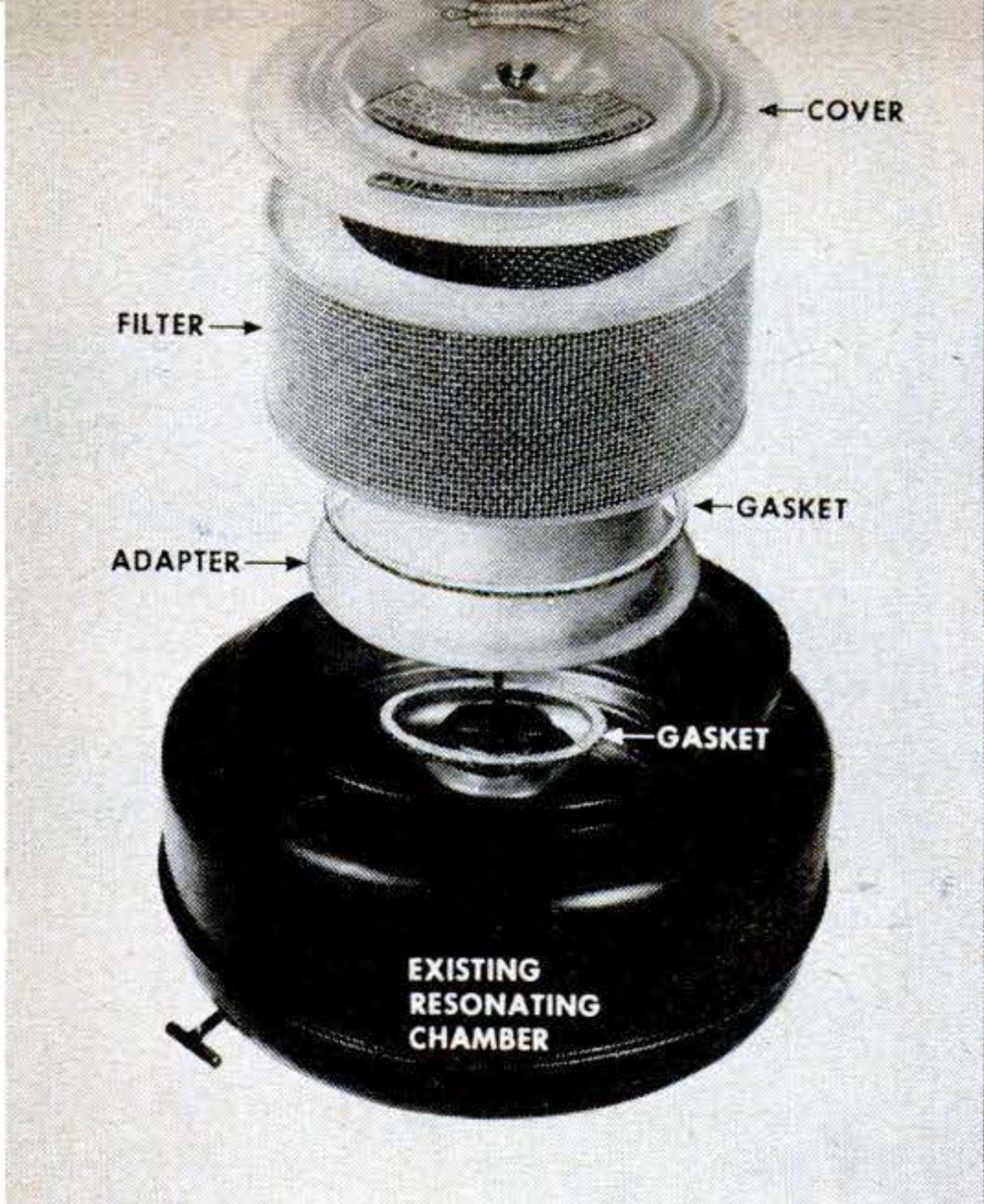
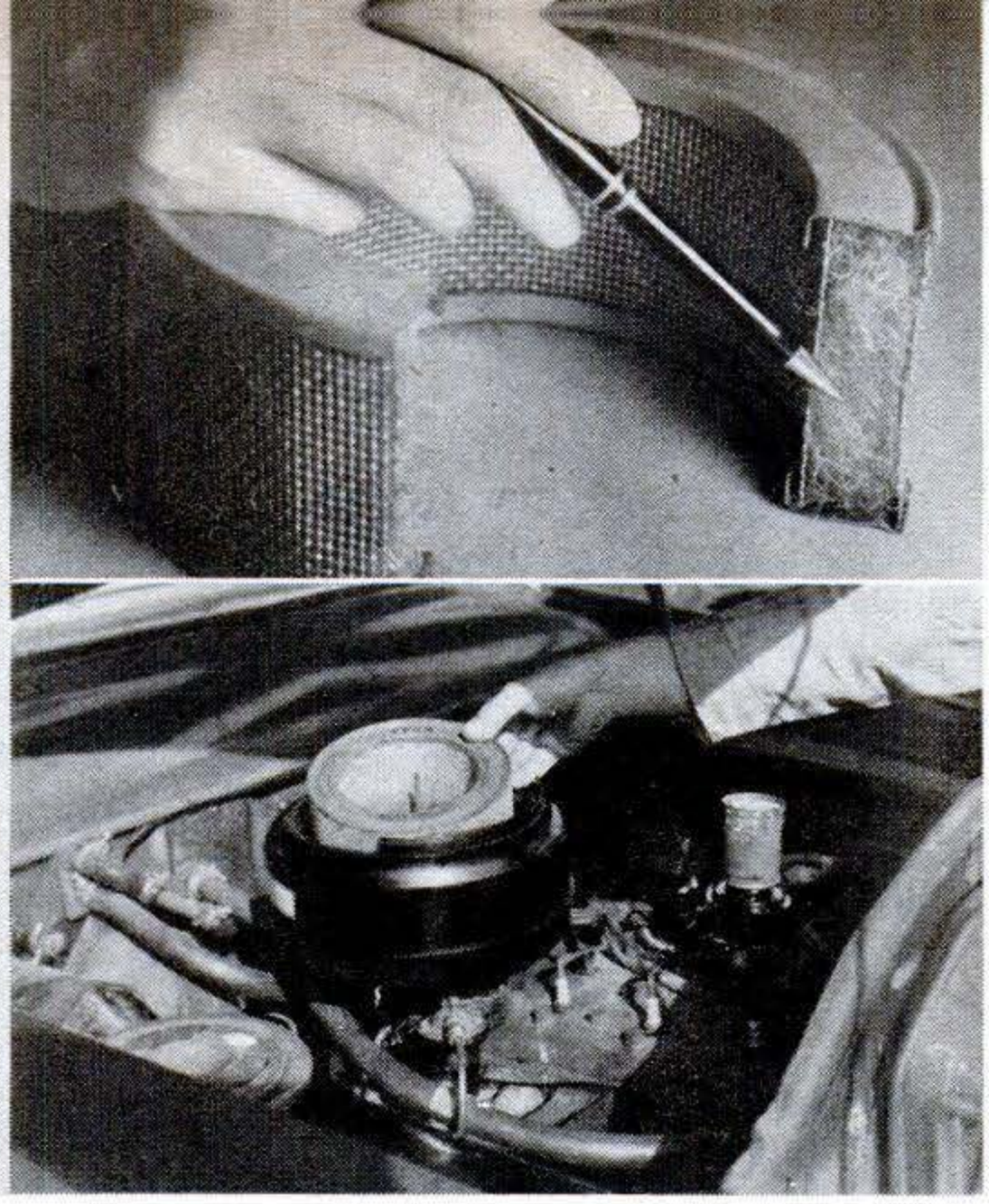




Air cleaner with replaceable filter developed by Fram Corporation consists of parts above. Cutaway cartridge at upper right shows filtering element, a new material called Framtex®. When dirt clogs the filter, an inexpensive new cartridge is installed, as seen in lower photo.

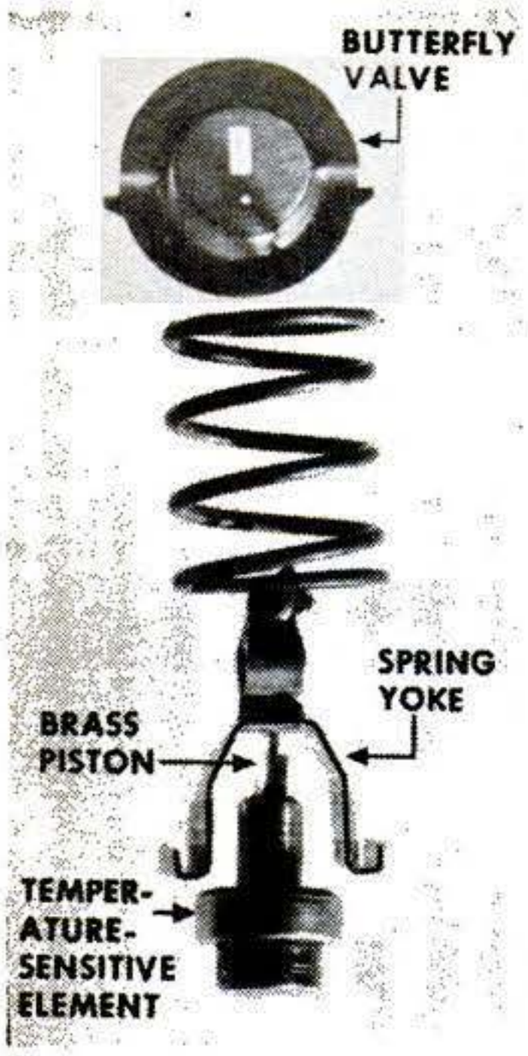
Air Cleaner Uses Filter Made of Milk Protein

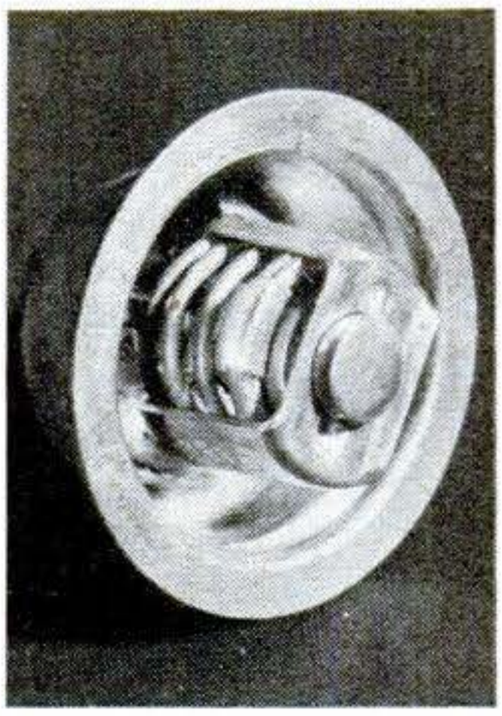
SURPLUS milk may soon help keep your automobile engine clean. A carburetor air cleaner announced by the Fram Corporation, Providence, R. I., uses a "curled casein filament." This is a fiber spun from casein, a milk protein, under a new process developed by the Department of Agriculture.

A dry filter, the Fram unit is designed for use inside a standard oil-bath cleaner. The oil is poured out and not replaced. The first installation of the unit costs just under $3.

Under normal conditions, the filtering element is good for 5,000 miles. When it clogs with dirt, poor engine performance signals the need for a change. (Fram asserts this is an advantage, since conventional filters may not indicate when they are badly clogged.) Replacement cartridges, at about $1.50, contain a chemically treated element made of 80 percent casein, 20 percent wool.

Heat-Sensitive Powder Opens New Thermostat





A copper capsule holds the actuating element. At the set temperature, element expands, forcing up piston and counteracting a 20-lb. spring.

SEVERAL makes of new cars are coming through with an unusual kind of cooling-system thermostat. Its temperature-sensitive element is a powder-filled capsule instead of the usual bellows or bi-metallic coil.

Developed by the Dole Valve Company, of Chicago, the new thermostat has a quick, positive action. Below opening temperature, a spring puts a 20-lb. pressure on the butterfly valve, keeping it tightly closed and providing quick warm-up of the engine. At the set temperature, the actuating element expands, counteracting the spring.

Although just breaking into the automotive field, the new Dole DV® has had extensive use in automatic washing machines. It is also offered as a replacement unit for all makes of cars.

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Mechanics and Handicraft

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Home Repairs with Copper PAGE 173

Midget Gas-Powered Plane PAGE 186

One-Tube RF Booster PAGE 192

Self-Timing Contact Printer PAGE 202

Altered gas mask lets sports divers take in the scenery 30 feet below surface. See page 168.

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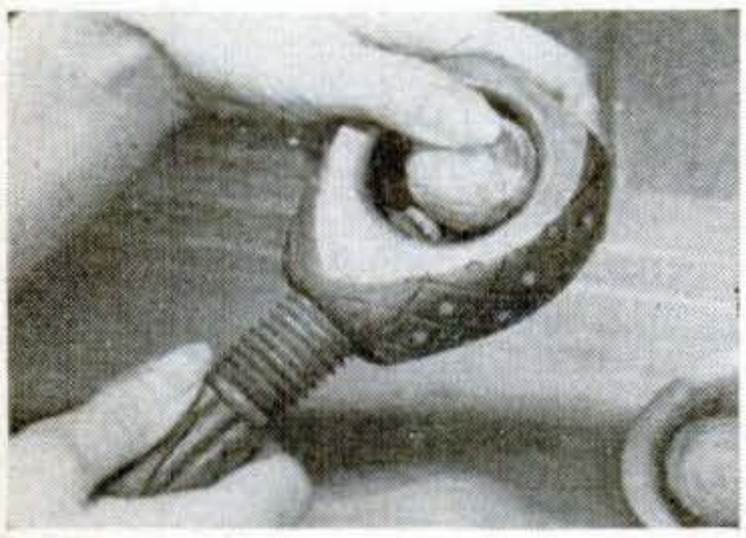
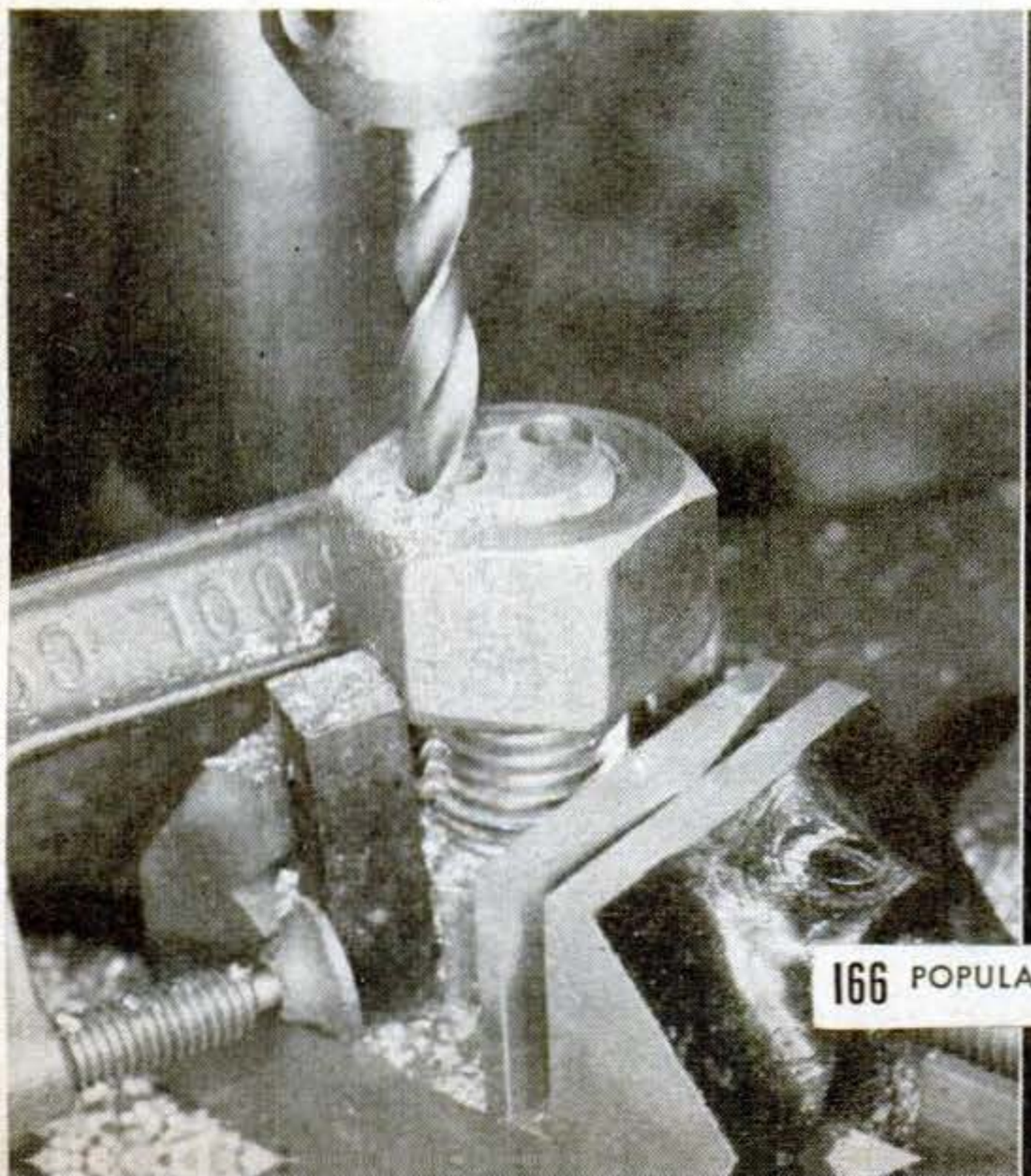
A dense, close-grained wood is best for this modern version of a very old kind of nutcracker.

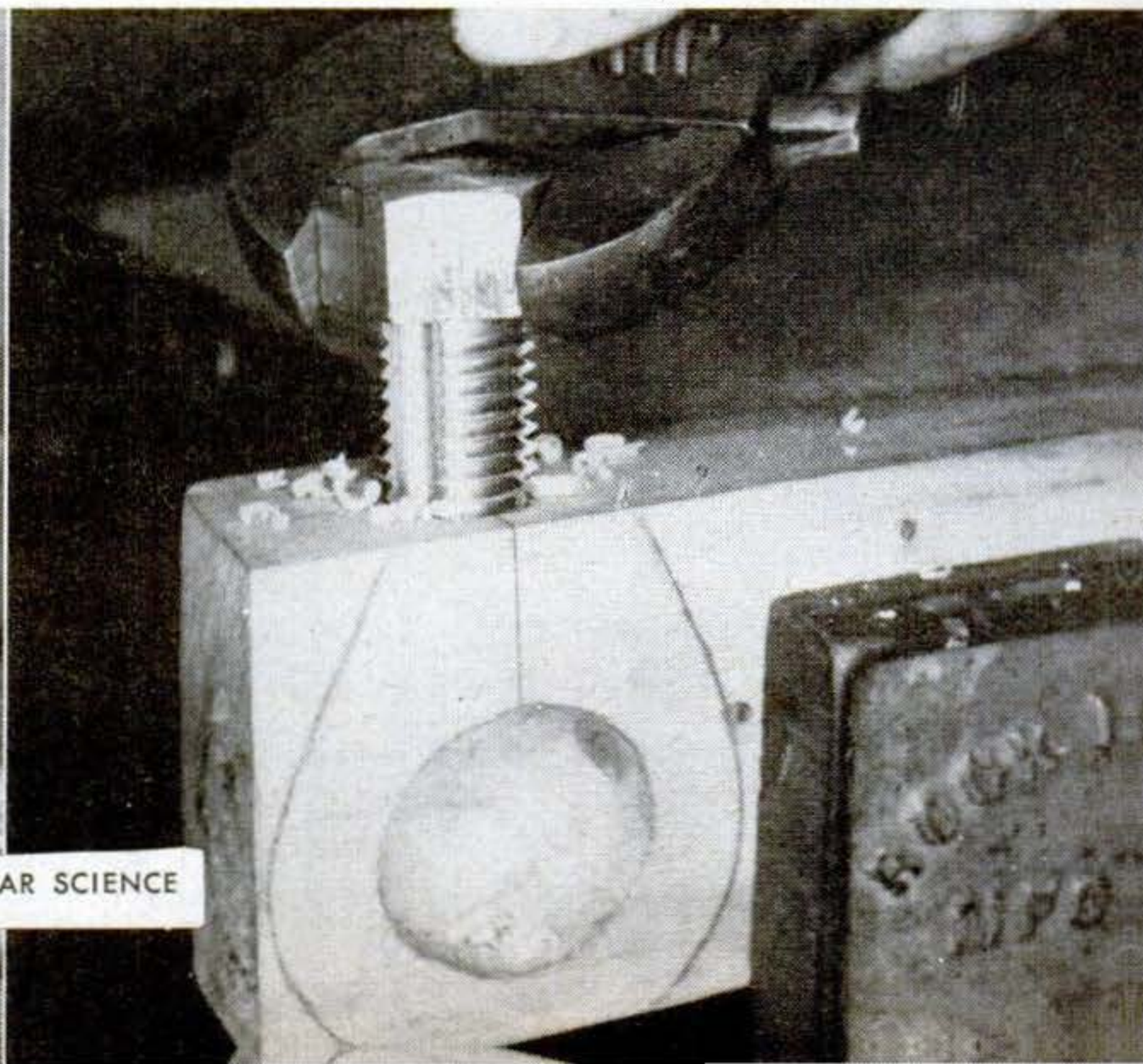


Wooden Nutcracker Works Like a Vise

Tap is made by drilling three equally spaced holes half in screw and half in nut. File tooth relief back of cutting edges, and remove burrs.

Tap the block carefully after drilling 13/16" pilot hole. Note that grain runs at 90° angle to the hole. Hollow nut cavity with gouge.





By W. A. Conway

HERE'S a project that can be either a comparatively simple job or a test of your whittling skill. It all depends on whether you employ a screw-cutting lathe or die to form threads on the nut-cracking screw—or carve them carefully by hand.

In any case, of course, you'll need a tap for the internal threads. You're all set if you own a tap for a standard 1″-8 V-thread. If not, you can make a tap from a hex-head cap screw and nut as shown in the photo on the opposite page.

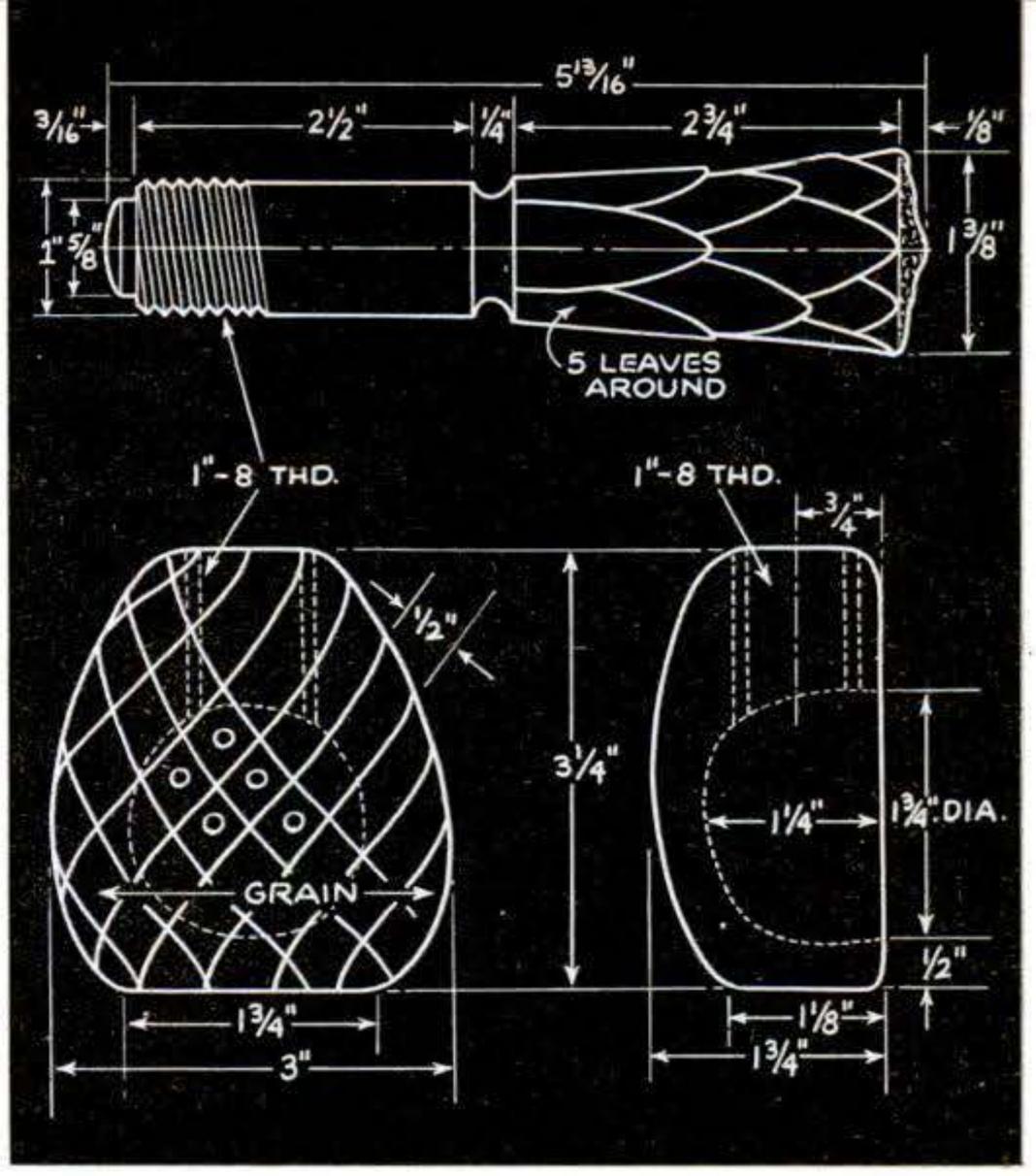
Wild thorn-apple wood was used to make the nutcracker shown, but hard maple, burl walnut, or similar woods would be fine. Cut a block 1¾″ by 3¼″ by 3¼″ with the grain at right angles to the screw hole. You can rough out the nut cavity with drills, and then finish with a gouge and sandpaper.

After tapping, shape the block by sawing and carving. Lay out the lines of the pineapple pattern with a pencil. Form the dots with a knife point or twist drill.

A blank for the screw and handle can be whittled from 1½″ square stock or turned on a wood lathe. Be sure that the screw portion is straight and exactly 1″ dia.

At this point, you can resort to a screw-cutting lathe—or perhaps make a die out of the hex nut you've already drilled. But if you like whittling, carving the threads presents a real challenge.

For this, cut strips of tough paper exactly ⅛″ wide. Blacken one edge with ink. Then cement the end of a strip to the screw blank.



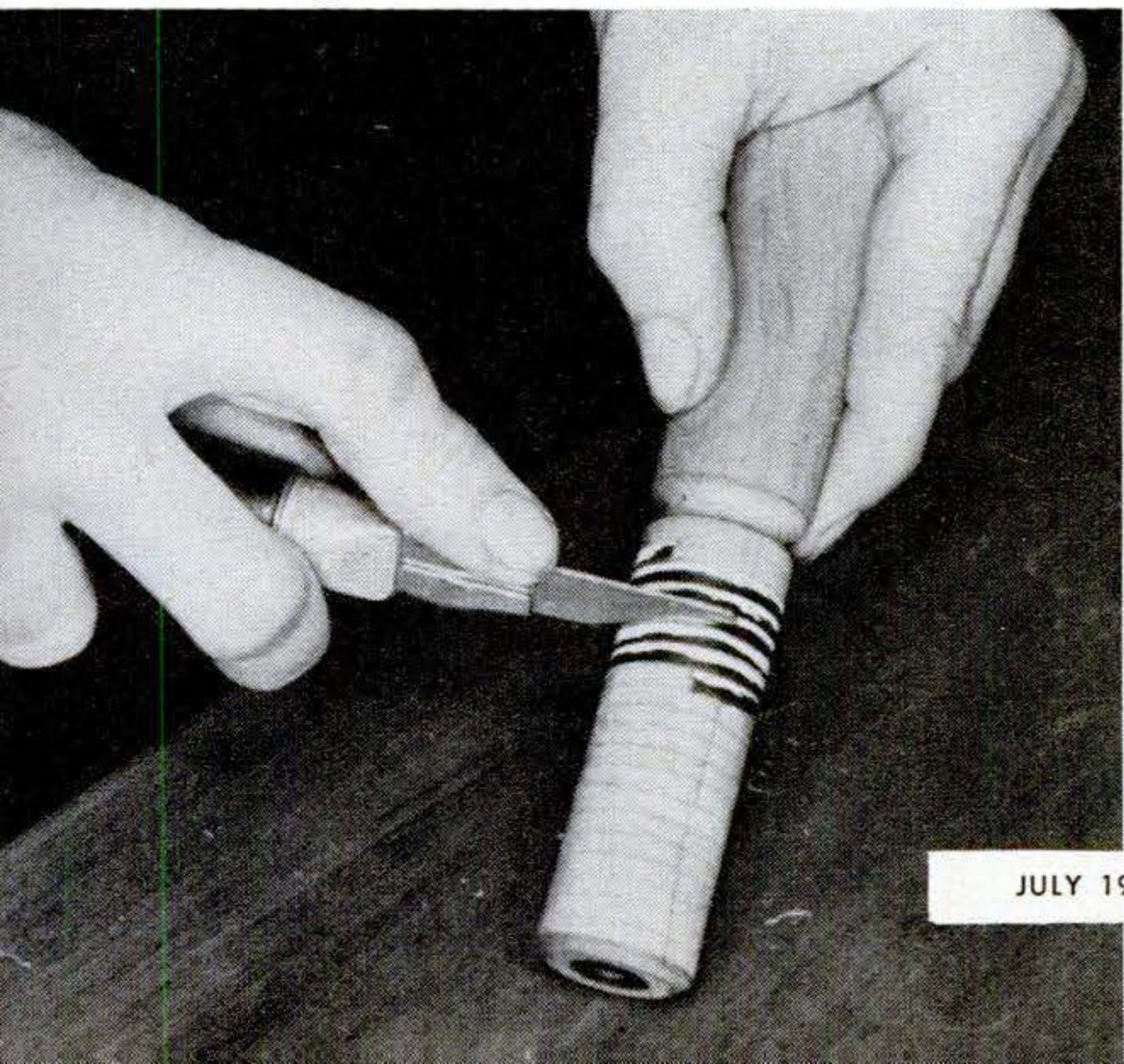
Wind the strip carefully and tightly in a right-hand spiral around the blank with the edges just touching. Repeat until blank is covered.

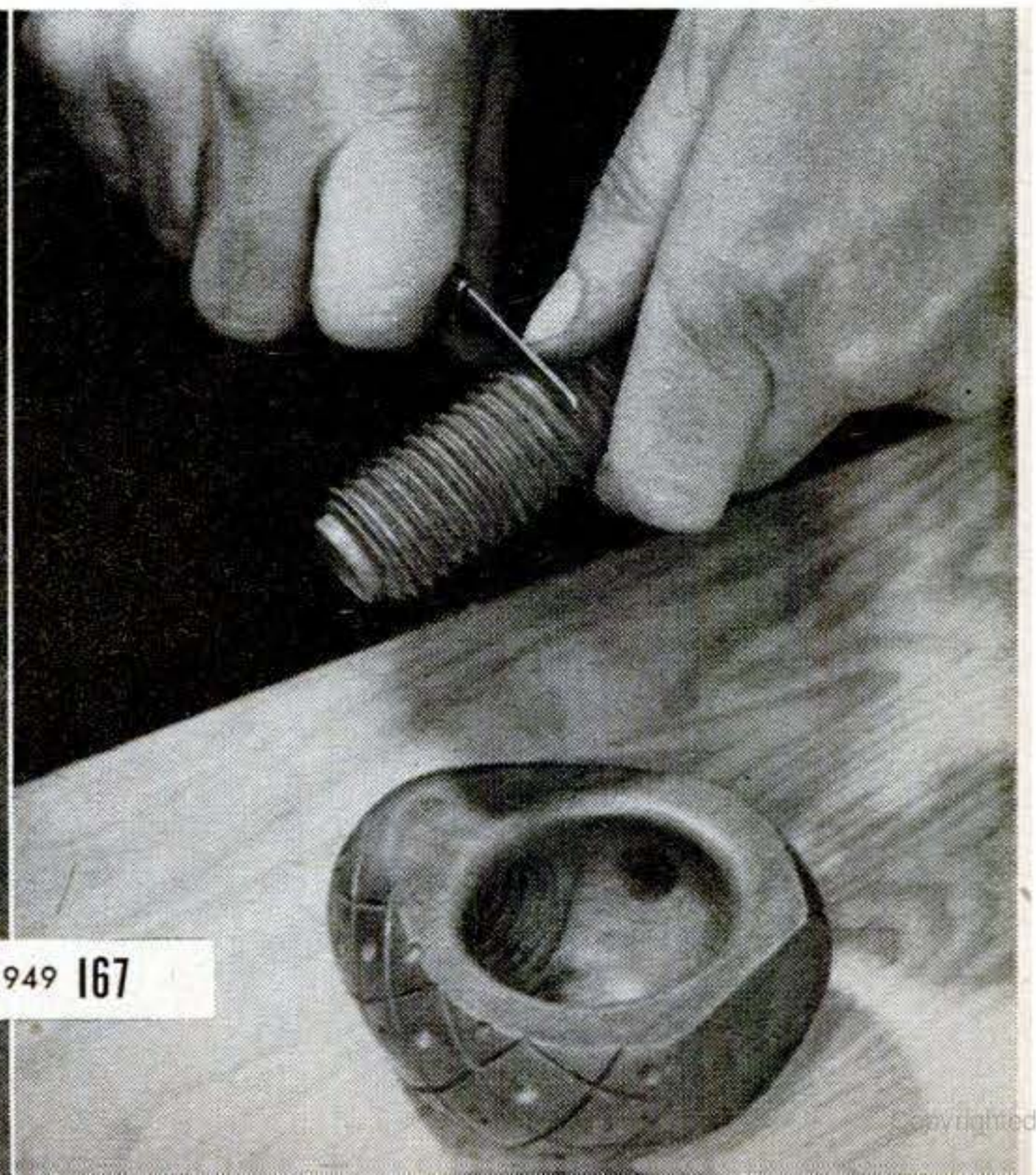
With a sharp knife, cut into the blank between the paper edges. This will establish the lead of the thread. Whittle out along this line a little at a time. As the thread takes shape, check by fitting it into the tapped body. To find tight spots, you can rub the thread with chalk or soft pencil and observe where smudges occur.

Carve the leaves on the handle in shallow relief. On light-colored woods, the handle can be stained green and the body maple to give a natural pineapple coloring. Otherwise, apply several coats of boiled linseed oil. Then wax well. END

Strips of paper ⅛″ wide, wound in a tight spiral around blank, provide guide for establishing the thread lead. Mark with sharp knife.

Carve the threads by cutting just a little at a time. Check progress by turning into tapped body. Finish up with a small triangular file.





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Simple conversion of surplus Navy gas mask makes possible underwater jaunts to a depth of 30 feet.

Walking Under Water

By E. R. Cross
Director, Sparling School of Deep Sea Diving
Photos by Don English

THIS homemade diving outfit, built around a surplus Navy gas mask, has been used for spear fishing, exploring the bottom, and making submarine photos. Boatmen have used it to inspect and clear fouled propellers and free clogged intakes.

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The same mask can be used two ways. In one, a hose from a pump on the surface—either hand-operated, as shown on the opposite page, or motor-driven—supplies the diver with air. In the other, a compressed-air tank is strapped to the diver's back, freeing him of a topside air connection. Both outfits are designed for shallow water. They're practical only for depths to 30 feet.

We've found the use of a hose for an air supply more convenient and practical than bottled air. The diver has more freedom of movement without the tank strapped to his back, and he can stay down for longer periods. An air bottle of the size shown, with a 2,000-lb. working pressure, will supply a diver for about 20 minutes.

Besides the gas mask, here are the parts that went into the outfit: Army cartridge belt, oxygen hose, nonreturn (check) valve, T adapter, small piece of gasket rubber, and the tools shown in the photo at right.

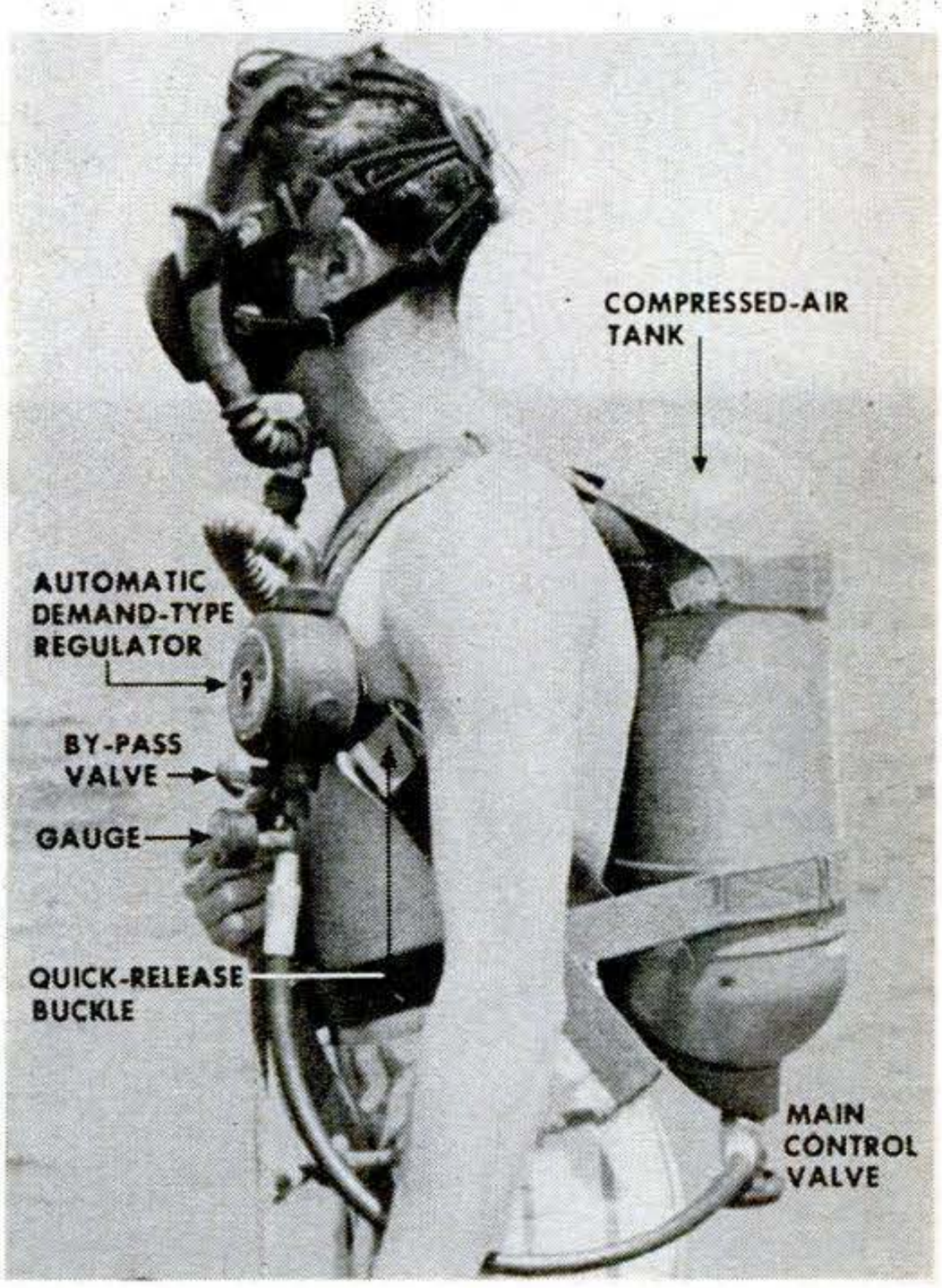
The Army cartridge belt is used to carry lead weights. By adjusting the number of these weights to suit his buoyancy, a diver can attain almost complete freedom of movement. Swim fins worn on the feet speed movement through the water. The nonreturn, or check, valve was inserted between the T adapter and the air hose. Once air has entered the mask, the nonreturn valve prevents it from escaping back into the hose if pressure from the surface should drop.

Although the flutter valve on the mask could have been used as an exhaust, it would let the air bubble up in front of the mask, obscuring the diver's vision. For this reason, we removed it and closed the connection for the valve with solder. The air then exhausts around the top edges of the mask, giving the diver unimpeded vision. To make a stronger, more watertight seal, the thin plastic diaphragm was removed from the front of the mask and replaced with gasket rubber.

We generally use a hand pump to supply the diver. However, when we switch to a gasoline-driven compressor, a regulating valve is inserted between the T adapter and nonreturn valve.

There are three sources of air supply for the converted mask: power-driven compressor, hand pump, and high-pressure bottle. For sports divers, the cost of labor for hand pumping generally is not an important consideration. This is strictly a team sport, and we dive as a group. Two people pump, one tends the life line and air hose, and one dives—rotating until all have dived.

Here are basic materials and tools used in converting surplus Navy gas mask to a diving outfit. The hose that supplies air is not shown.



Alternate conversion uses air tank on diver's back. No surface connection is necessary but life line to belt is strongly recommended.

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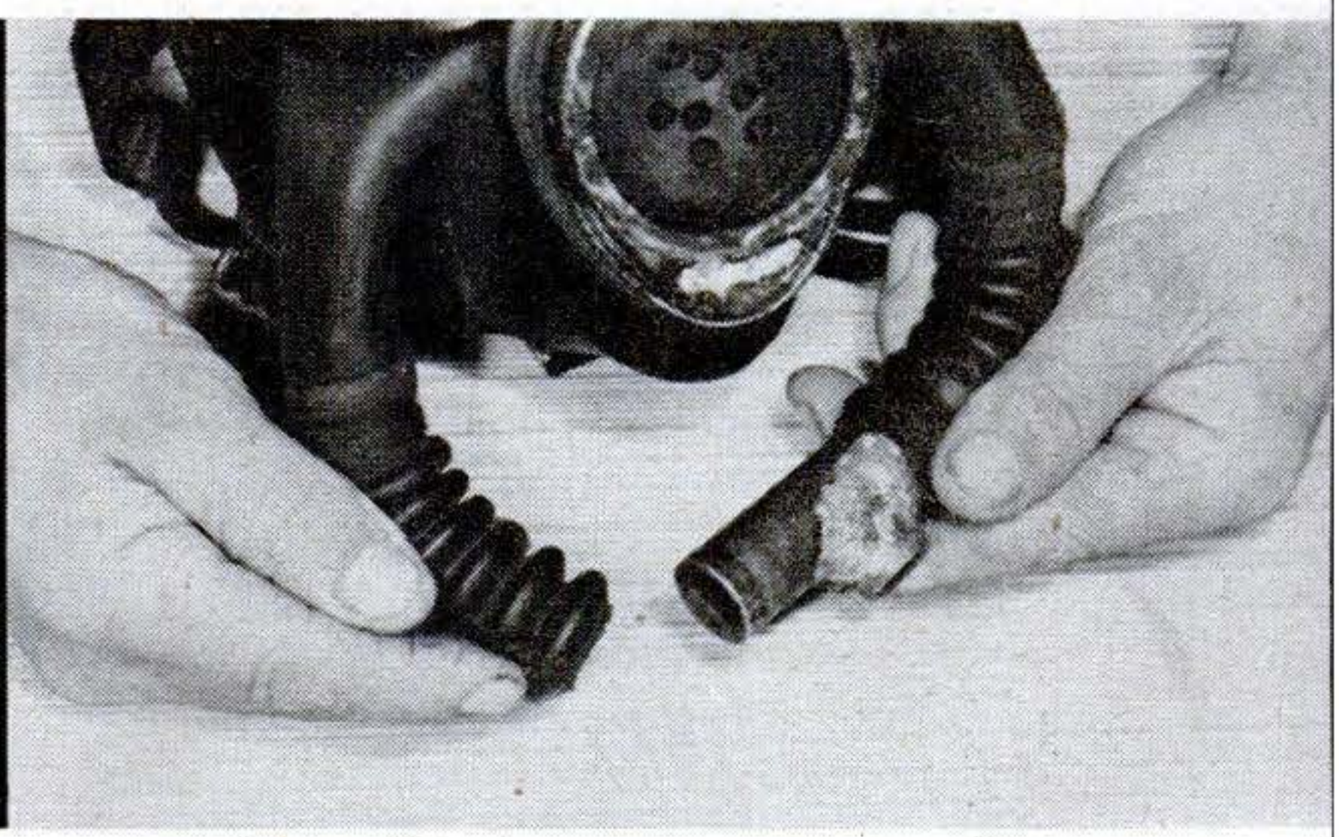
1. First step in conversion was to remove flutter valve and to close its connection with solder. Next, the corrugated tubes were cut between sixth and seventh ridges as shown. The shorter hoses assure a more rigid connection for T adapter, nonreturn valve, and air hose.

Because of this availability of personnel, a hand pump is the most popular air supply. Three pumps suitable for sports diving are the Morse No. 15 (shown in use on page 168), the Morse No. 17, and the Miller Dunn No. 1. Any of these will supply sufficient air for a diver wearing a mask to depths of 25 or 30 feet. These three pumps are available as government surplus for about $30 or $35 each.

Here are two hints on operating hand pumps. First, a small tank between pump and diver acts as an air dome, leveling out pulses and giving a more even flow of air. Connect the hose from pump to tank and from tank to diver. Second, use the full stroke of the pump.

Gasoline-driven compressors suitable for shallow diving are also available but are much more expensive. Electric-driven compressors are not recommended for use around water.



3. Diaphragm, ring, metal disk, and diaphragm retainer then were reassembled and unit screwed in place. Next, the ends of the T adapter were inserted in the corrugated tubes. They were forced well up into the tubes and secured as shown in the photograph at the right.

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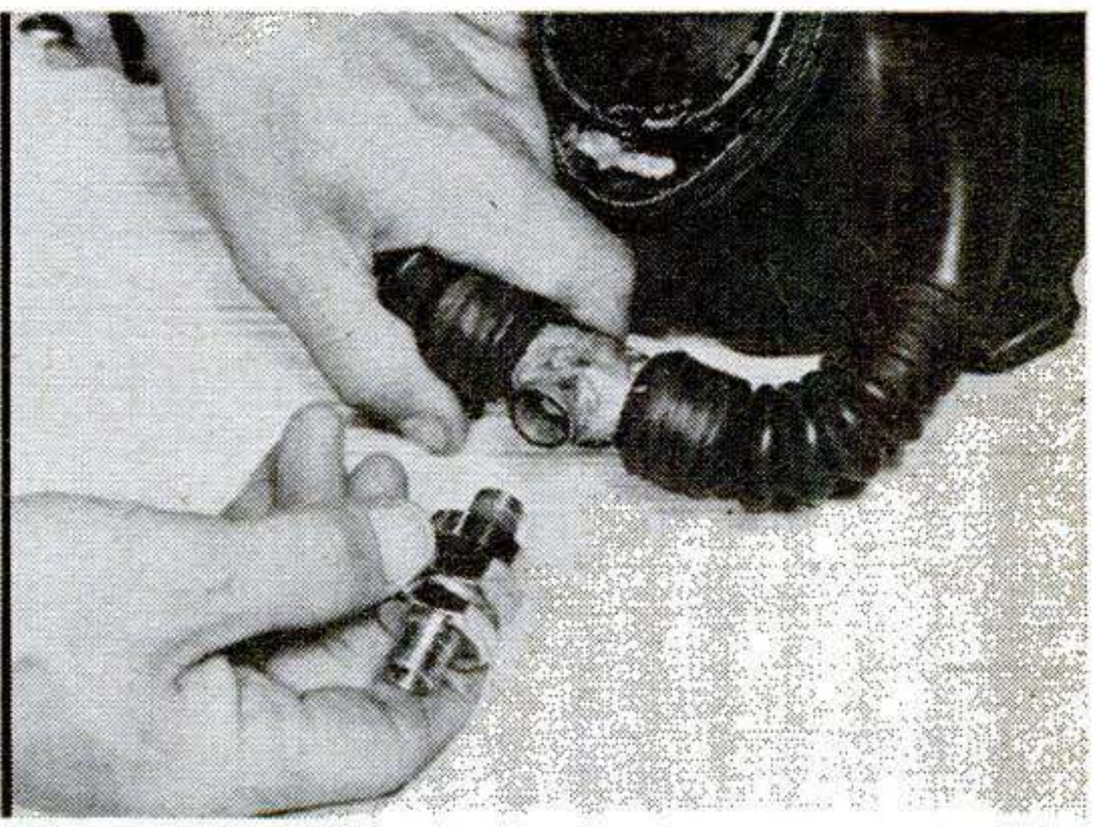
2. Thin plastic diaphragm was removed by unscrewing diaphragm retainer and removing metal disk and ring. Circle of gasket rubber was cut to fit diaphragm receptacle exactly. This replacement makes for a stronger and much more watertight seal at front of mask.

A diver using the mask should have about 1.5 cu. ft. of air per minute, delivered at a pressure slightly above the pressure existing at the depth where he is. As most diving will be in water 15 to 30 feet deep, a diver needs about 3 cu. ft. of air a minute.

It's desirable to have a gauge at the pump or tank. The pump should be worked fast enough to provide about 5 lb. more pressure than the diver actually needs at any particular depth. In salt water, depth times .445 equals the pressure needed. In fresh water, depth times .435 gives the required pressure. For example, if a diver is at 25 feet in salt water, 25 times .445 equals 11 lb. Add the 5-lb. extra margin to that and you have 16 lb., the gauge pressure the pump should maintain for a diver at 25 feet.

In building our second outfit—the one with the air bottle—the nonreturn valve was replaced with an automatic demand-type regulator. This permits air to enter the mask



4. Tubes were wrapped with two turns of friction tape and wired. Tape prevents wire from cutting tubes. Third turn of tape covers wire to give smooth surface. Final step was to screw nonreturn valve into T adapter and connect air hose to nonreturn valve.

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only when the diver inhales, greatly conserving the air supply. You'll notice in a photo on page 169 that we inserted an air gauge and bypass valve between the tank and regulator. The gauge, of course, shows the amount of air—in terms of pressure—remaining in the tank. Normally closed, the bypass valve is a safety measure. If the regulator should fail, the bypass valve can be opened slightly to allow a flow of air to the diver. High-pressure hose is used.

Note in the photo that the regulator was placed at almost the same level as the air inlet to the mask. If it were much lower, the greater water pressure there would allow a continuous flow of air to the mask.

Quick-release buckles were used on the harness supporting the air tank. There are three of these, one at each side and one on the belt. If the diver should get into trouble, he merely has to flip these three buckles, slip the mask from his head, and swim to the surface. A life line, attached to the harness rather than to the diver himself (for speed in emergency escapes), is used even with the self-contained unit. With the other one, the line is taped at frequent intervals to the hose.

We have used these units in exploring the marine gardens at Catalina Island and for underwater photography. When we are diving, our boat becomes the center of attraction. Visitors usually want to try their hand at submarine exploration. Those who demonstrate that they are expert swimmers dive, first with one of us, and then alone.

It's a good idea for the diver and his topside companions to arrange a system of signals. Tugs on the line usually are used. Here's the code Navy divers use:

FROM TOPSIDE TO DIVER

1 pull	Are you okay?
2 pulls	Go down.
3 pulls	Stand by to come up.
4 pulls	Come up.

FROM DIVER TO TOPSIDE

1 pull	I am okay.
2 pulls	Give me slack.
3 pulls	Take up my slack.
4 pulls	Haul me up.

The unit using the high-pressure bottle was built for about $60. Cost of the other outfit was somewhat less since we didn't need a tank, gauge, regulator, or harness.

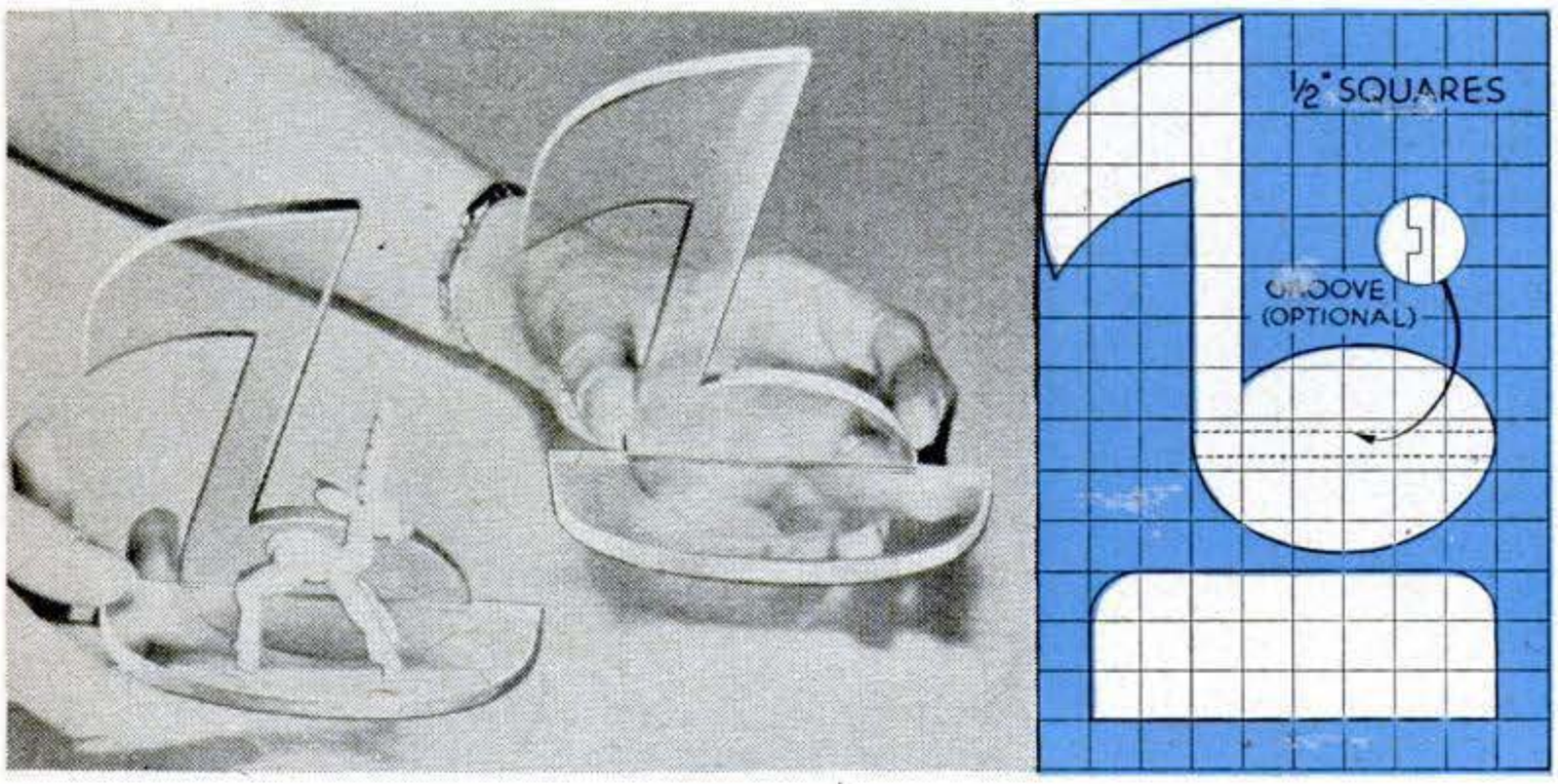
By following a few rules, we find that even inexperienced divers (including an 11-year-old boy and a 65-year-old woman) can use these outfits with complete safety. An important point about which we always caution novices is to breathe normally while ascending. And, if the mask is accidentally pulled from the face, to exhale while ascending. A diver shouldn't hold his breath while rising because air taken into the lungs under pressure would expand with reduced water pressure. This might cause air embolism or rupture of the lungs. However, this danger wouldn't be great unless the diver had his lungs completely filled with air when he started up. We also always avoid tricky tidal currents. END

Musical-Note Shelves Cut from Colored Plastic

CUT in pairs from colored plastic, these musical-note knickknack shelves are an easy project for a single evening. Choose plastic to suit the color scheme of the room in which the shelves will hang.

The shelves shown below were made from ¼" sheet plastic. For the job, you need only a jigsaw, files, and emery paper.

Following the squared drawing, lay out each part on the protective paper of the plastic. Saw along these lines with the paper still in place. Finish with a file and smooth the edges with emery paper to give a frosted appearance. If equipment is available, a groove cut for the shelf piece will strengthen the joint. Cement with glacial acetic acid or ethylene dichloride. A nail through a small hole drilled in the top of the note suspends the shelf.—*J. Jachimowicz, Washington, D. C.*



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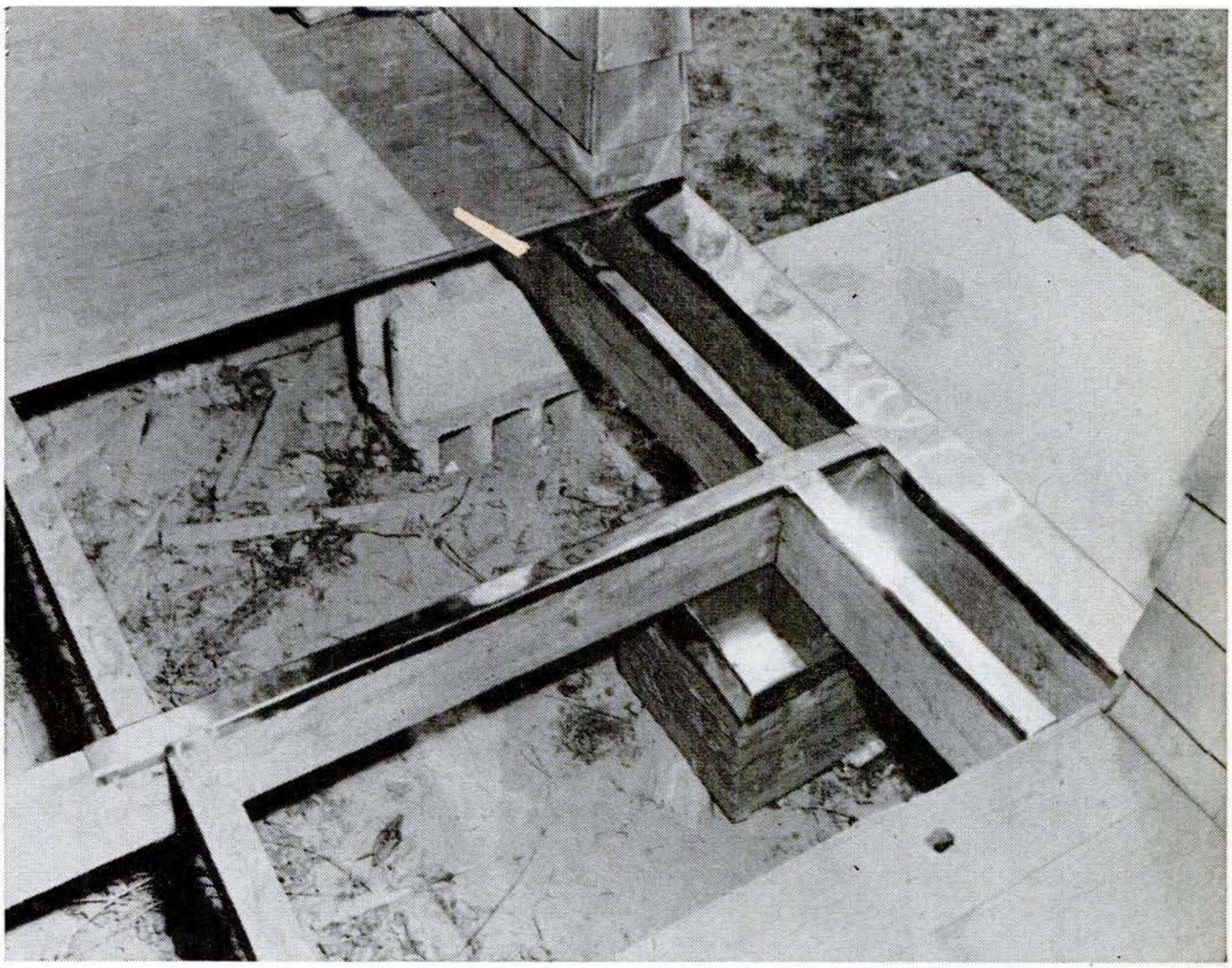

Copper protects floor timbers of open porches from seeping rain water. Note sheet copper cap on brick pier. This keeps water from working its way down into the mortar and loosening it.

Home Repairs You Can Make With Copper

By Harold R. Terpeny

FOR lots of handyman repairs, sheet metal will do a better job than any other material. Perhaps the best all-around repair metal is sheet copper. It's easily worked because of its softness, and it'll never rust.

Suitable sheet copper can be bought from roofing supply dealers and many hardware stores. A convenient kit of 10 light-gauge 18″ by 48″ copper sheets is packaged by Revere Copper and Brass, Inc. Also included in the kit are 200 bronze nails and instructions for flashing roof valleys, chimneys, doors, and windows.

You can save yourself work and money by covering the floor timbers of an open porch with copper. Rain is a deadly enemy of porch timbers and replacing them can be a costly job. Either when building or repairing porches, cut strips of copper 1″ wider than the thickness of the timbers. These usually are 2″ stock. Bend the strips into U-shaped caps and lay them atop the timbers with the ends butted together. Smear the timber first with a heavy coat of roofing cement and press the copper on top of it. Be sure to use roofing cement, not roof coating. When the flooring is nailed down, the cement seals the nail holes in the copper. You now have a water-protected underpinning for your porch.

Many porches are supported by brick columns. Rain blows in, runs down between

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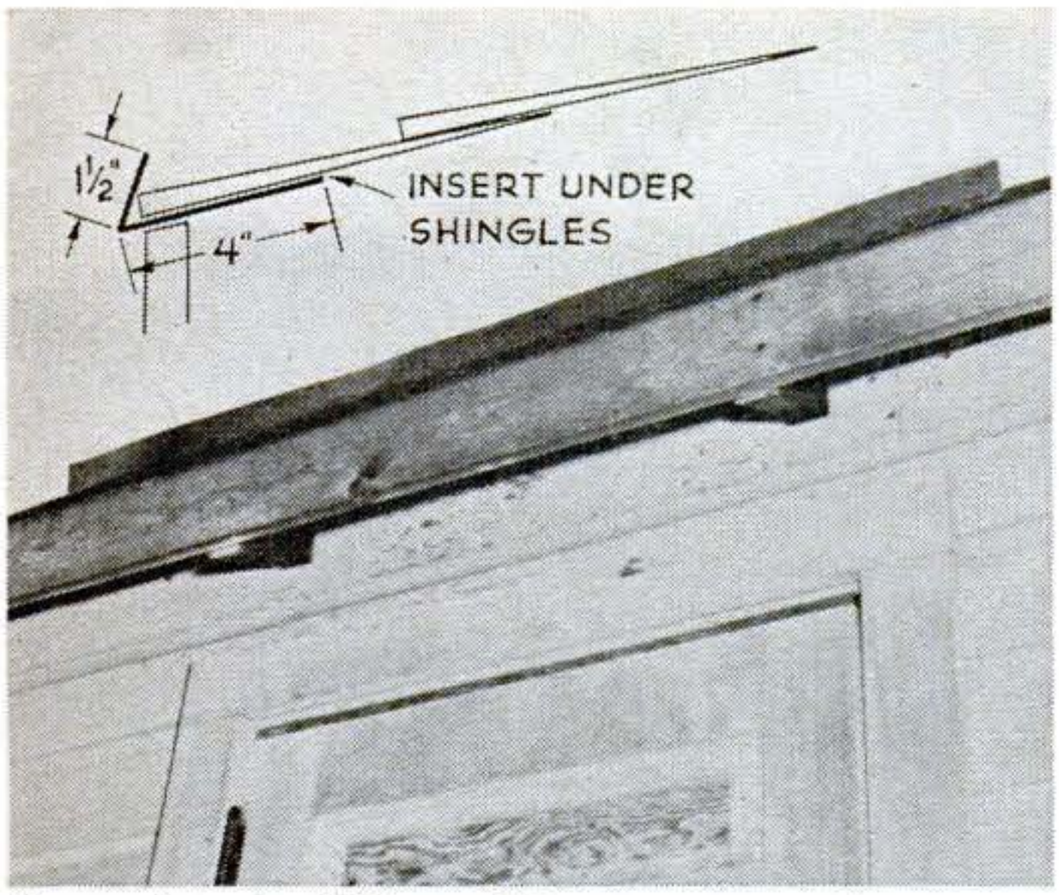


Gutterless buildings drip water over doorways. Strip of copper, bent as shown and inserted under shingles, guides water to either side.

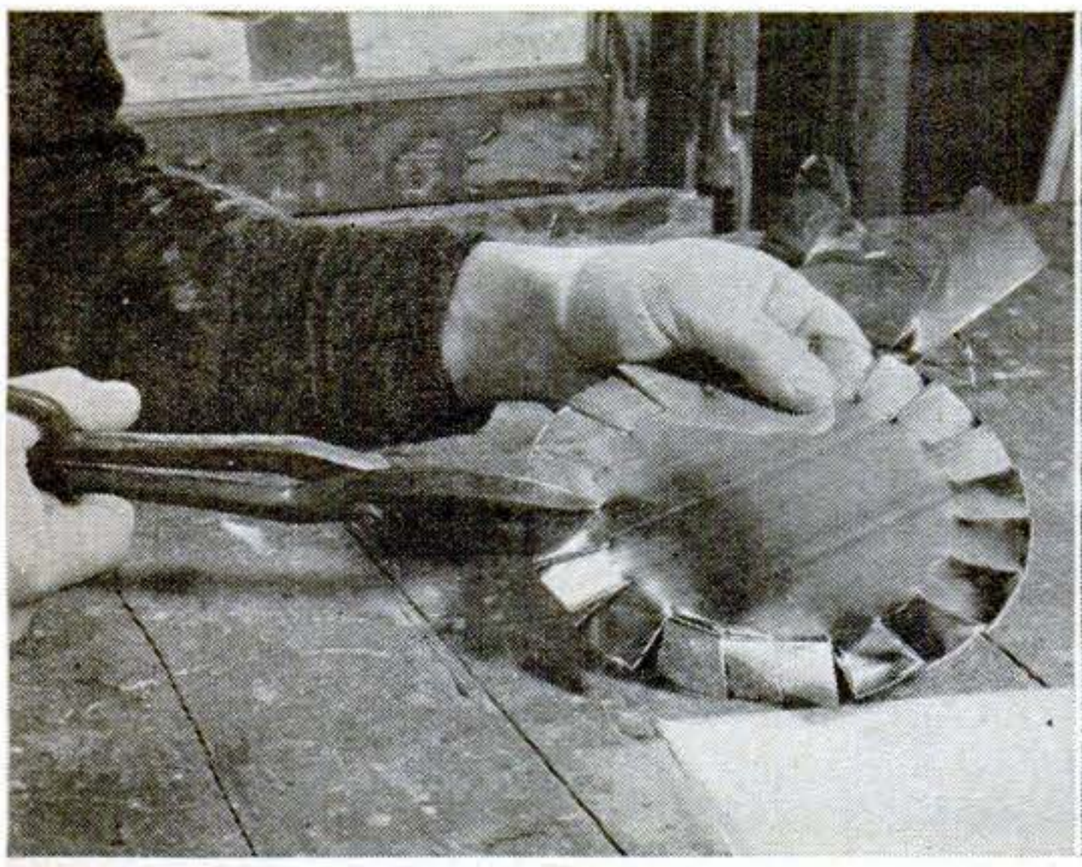
Copper covers holes made by birds or squirrels. Patch is not nailed but set in roofing cement. Here it's being tapped into place.

the floor boards, and eventually weakens the mortar between the bricks. The mortar begins to crumble and the top few courses of bricks become loose, leaving an insecure pier. When repointing old piers, cut a sheet of copper to cover the top. Make it 2″ wider all around than the top of the pier. Then jack up the timber a trifle and slip the sheet in place. Bend the sides down around the top of the pier. New piers should be capped before the timbers are laid.

A copper cap on a chimney top also is a good investment. The top courses of bricks eventually become loosened as rain works its way down into the mortar. Drawings and photos on page 176 show you the construction of a chimney cap. After bending the four sections of the cap, lay the short pieces on the bench, fit the long pieces, and solder the joints. To hold the cap in place, spread roofing cement on the chimney top and press on the cap.

Holes in the outside trim of a house may be patched with copper. Sometimes a bird or squirrel will make an entrance into the eaves by using a small hole or crack as a starting point. Cut a piece of copper to overlap the hole by about 4″ on all sides, if possible. Place the copper over the hole and mark around it with a pencil. Apply a coat of roofing cement around the hole, keeping a little inside the pencil line. Before sticking the copper in place, wash it thoroughly in vinegar so it will take paint. Vinegar removes traces of oil or grease on the copper. Then press the plate into the cement. Use kerosene to wash off any cement that may be squeezed out around the patch. Touch up the job with paint.

Copper patches are especially good if a



Posts last much longer if tops are protected from rain, which otherwise seeps into end grain. Right, tabs are bent down around post top. Bronze nails driven through tabs hold cap on.

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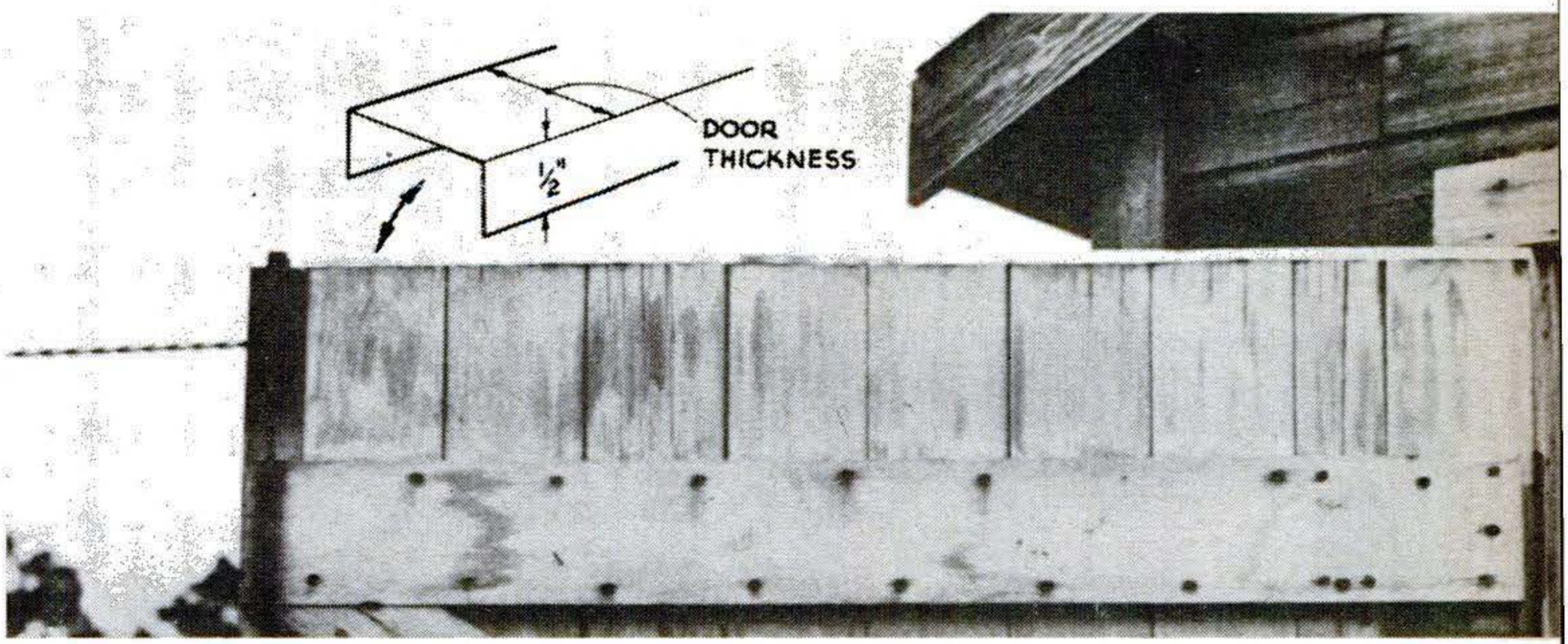

Garage doors, because they frequently stand open, are subject to rot from water along the top edges. Copper caps keep water out. Apply the cap with roofing cement and bronze nails.

hole covers molding as well as a flat piece of trim. The copper can be bent to fit the contours of the molding.

Cellar doors frequently let rain in, either at the juncture of bulkhead and wall, or at the door line. The photo at the bottom of this page shows one solution. If possible the flashing should be inserted when the wall shingles are installed, but you may be able to loosen them enough to get it up underneath. Instead of the curved wooden strip to carry off water, the ¾" section of the copper sheet could be made about 3" wide and bent up at an angle along the lower edge.

Tops of garage doors take a beating from the weather. Since at least part of the tops are end grain, they don't take paint very well and are prone to rot. A tight-fitting cap of copper will protect them.

Posts will last years longer if the tops are

Holes in woodwork gnawed by mice or rats can be permanently and securely sealed with patches of sheet copper. Nail in place.

Leaks in cellar hatchways can be stopped by a flashing bent up of copper. Strip is best fitted under shingles or clapboard when these are renewed. Curved batten drains the water away.

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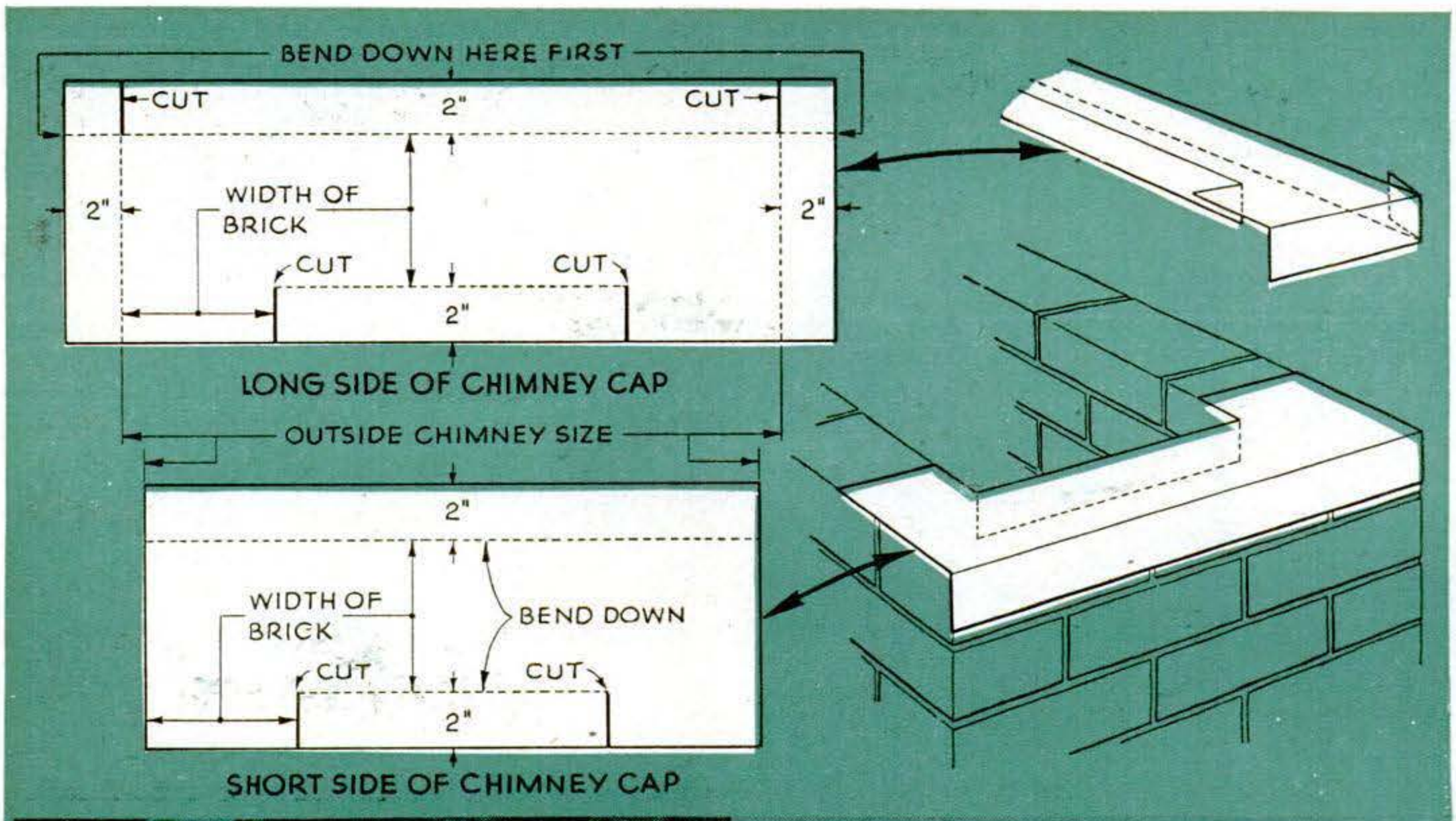
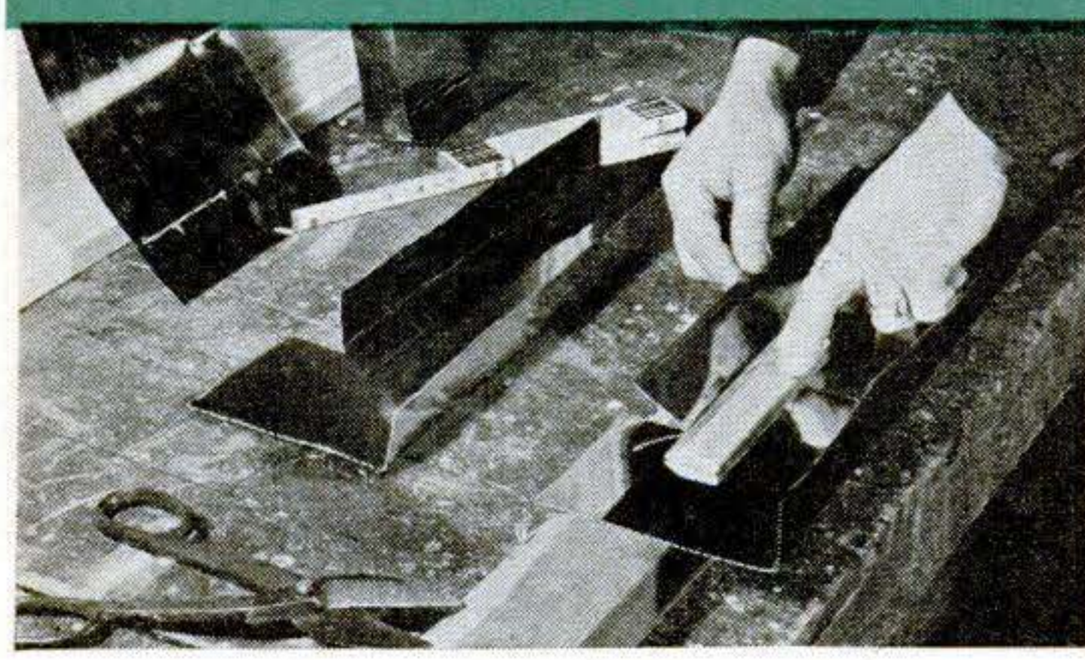


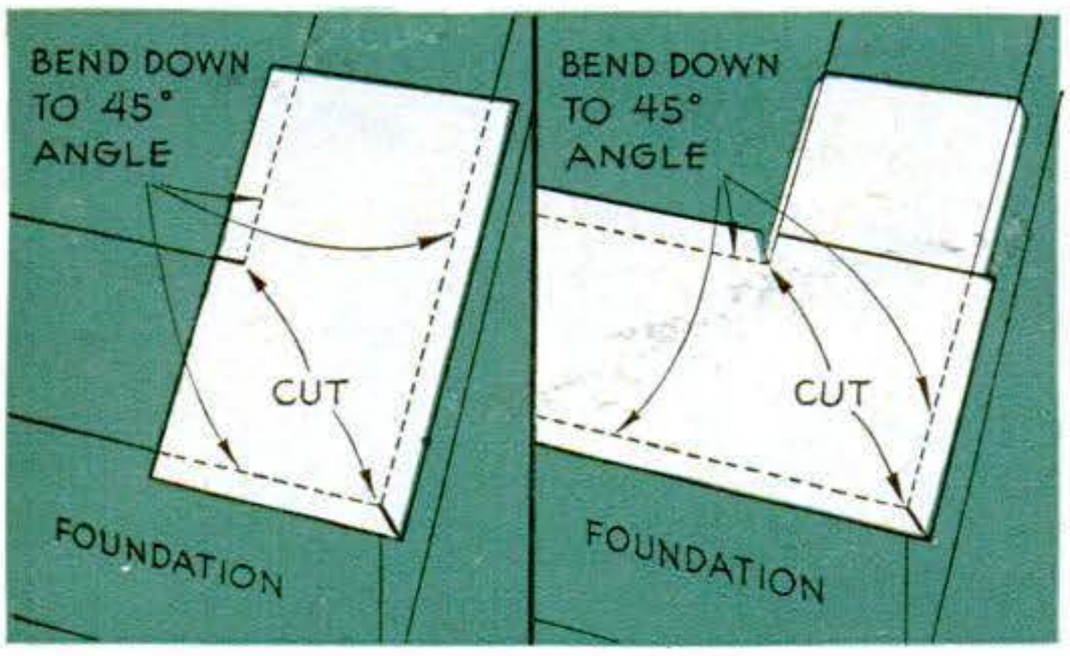


Caps for chimneys are bent up in four sections. Drawing shows where to make bends and cuts. The four sections are fitted and soldered together and then placed on the chimney. Top bricks of unprotected chimneys frequently work loose as rain weakens mortar.

protected from the weather. To make a post cap, measure the diameter of the top and scribe a circle ¼″ larger on a piece of copper. Using the same center, draw a second circle 2″ larger than the first circle. With tin snips, cut slits in from the circumference of the outer circle to the circumference of the inner circle. Place the cuts about 1″ apart. Put the cap atop the post and bend down the tabs. Drive a bronze nail into every third or fourth tab and you have a watertight cover that'll prevent rain from soaking in.

Termite shields are another valuable use for sheet copper. Install the shields on top of brick or concrete foundations. Cut the copper 1″ wider all around than the top of the foundation. That leaves ½″ on all sides. Bend these ½″ extensions down 45°. Termites can't crawl on the bend in the underside of the copper. To install the shield, lay it on the foundation and set the sill on top of it.

Sheet copper—if it goes well with the color scheme of your kitchen—makes nice drainboard covers and splash boards. Decorative effects include hammering, chemically darkening, and patterning with steel wool. Another use is as a drip pan for an oil heater. Turn up the sides of the pan about ½″ and solder the joints. END



Termite shield. Edges are bent down to 45° angle (which termites can't negotiate) on underside of sheet. Sills hold guards.

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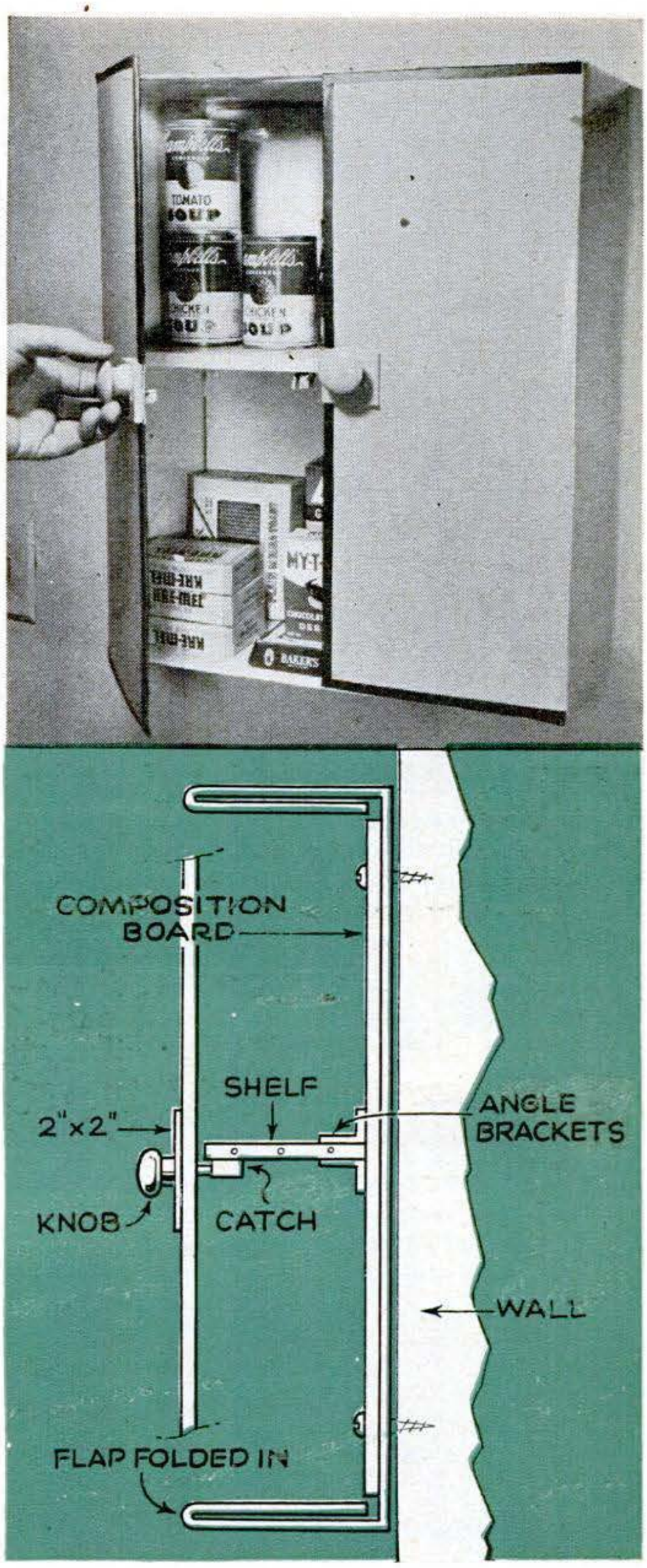
Grocery Carton Becomes a Cabinet

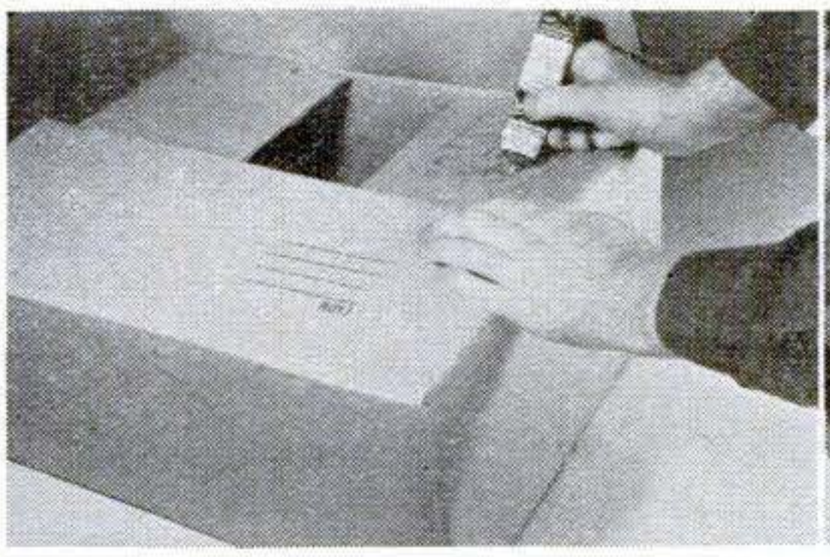
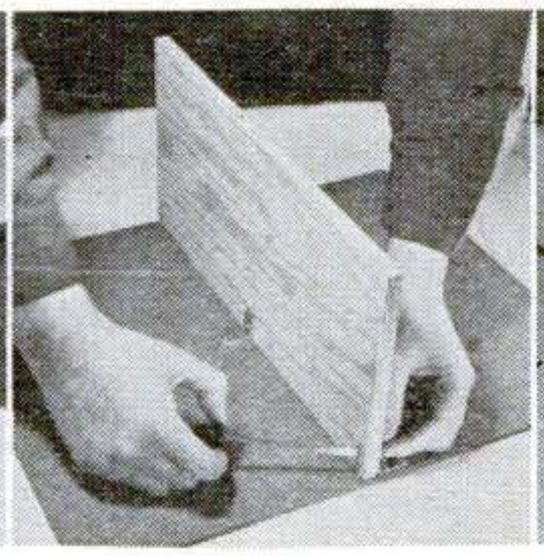
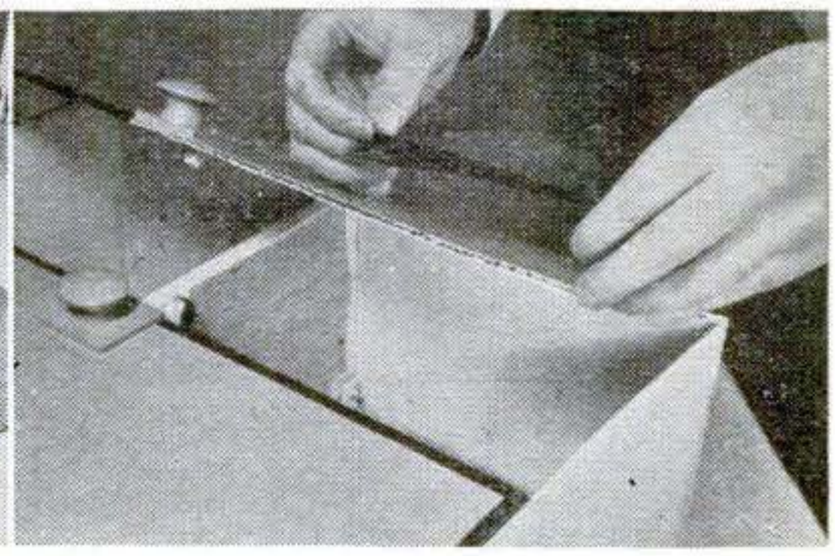
THE humble corrugated carton that you can pick up at the corner grocery has the makings of a surprisingly sturdy utility cabinet. Especially handy in crowded or temporary quarters—you can throw it away without compunction when you move—it will also serve in the kitchen, porch, basement, garage, or summer cabin. It costs nothing or close to it and, when coated with a high-gloss enamel, looks quite shipshape.

In addition to the carton itself you will need a sheet of ⅛″ or ¼″ composition board to reinforce the back. To this one or two shelves are attached with angle brackets. The back stiffens the carton, permits easy mounting, and carries most of the load.

Cement or glue the back flaps closed and fold in and glue the short flaps in front. The longer front flaps are used as doors. After placing the back panel and shelf or shelves in position, drive a couple of nails through the cardboard sides into the shelf ends. Cabinet knobs mounted on 2″ by 2″ plywood squares are fastened with screws from inside. Cabinet catches are attached to the knob-mounting squares and the underside of the shelf.

Paint the cabinet inside and out with an enamel undercoater. When dry, steel-wool every part smooth and apply a high-gloss enamel. Edges are trimmed with decorative cloth tape, which can also be used to reinforce the door "hinges."—*Arthur C. Miller, Manhattan, N. Y.*



Back flaps, if not already secured, should be glued or cemented together (left). In front, the short flaps are folded in and glued, while the long ones become doors. A shelf (center) is attached to a composition-board back panel that stiffens the carton and holds much of the load. Exposed edges of the cardboard are covered (right) with decorative cloth tape.

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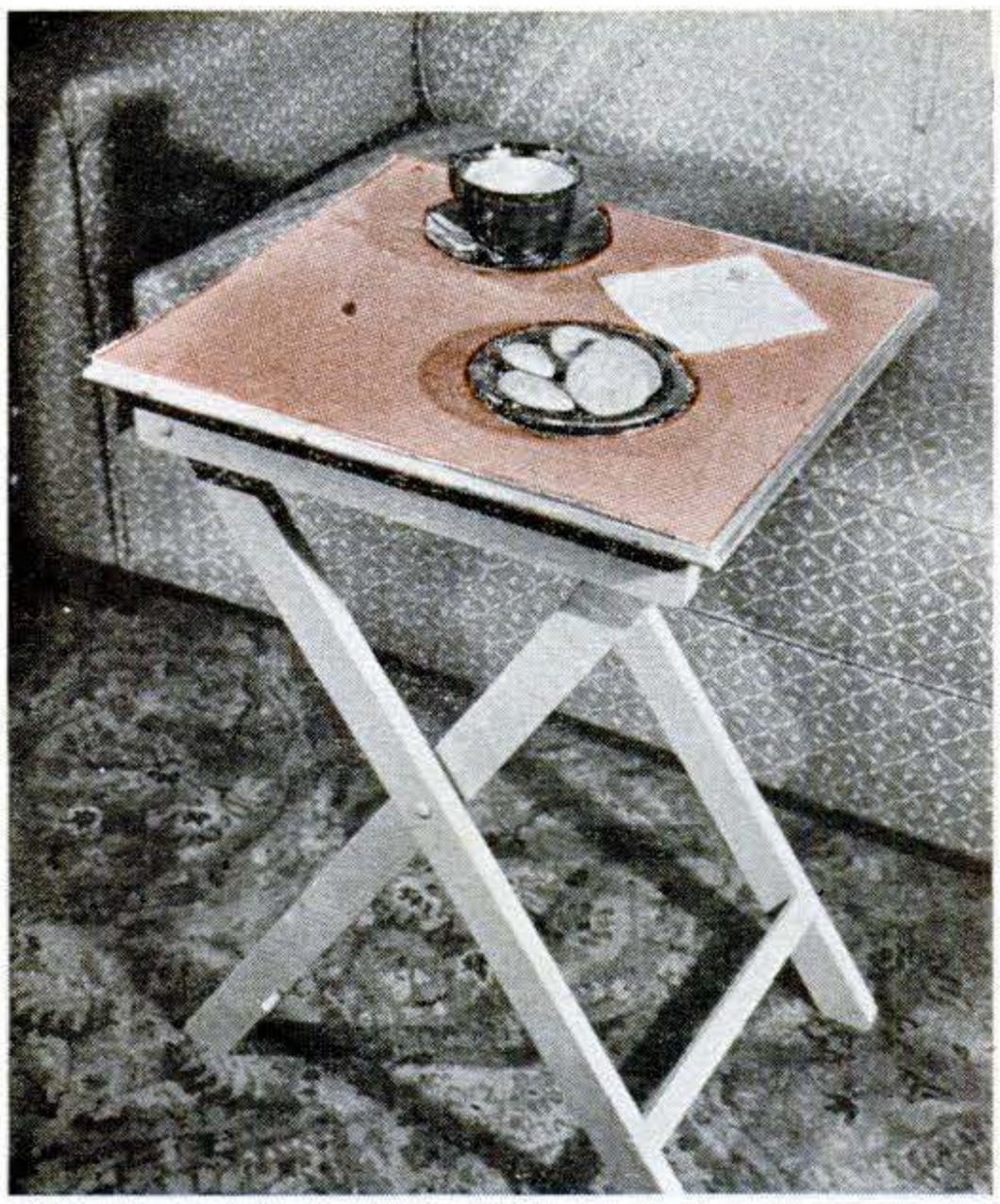
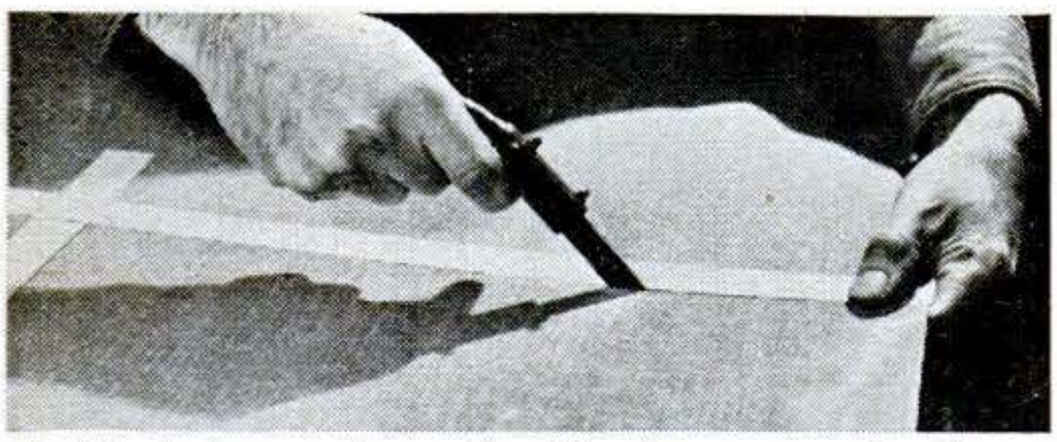
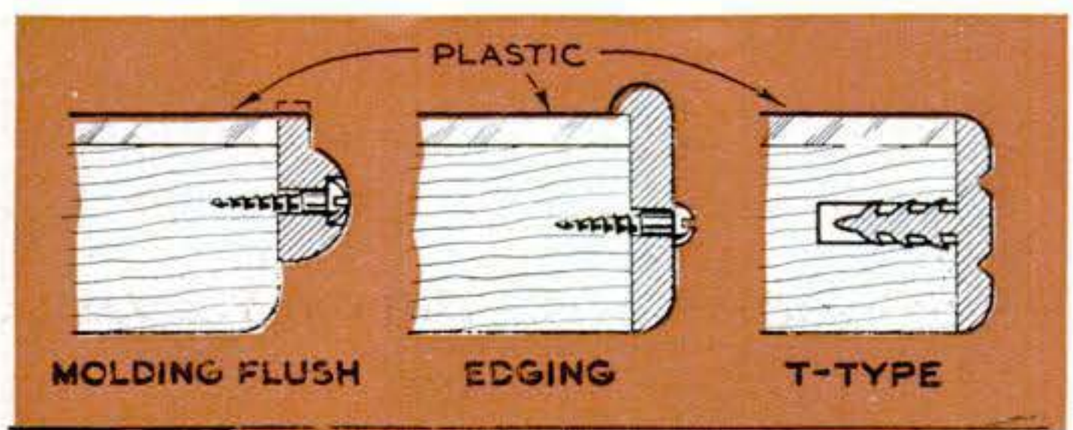
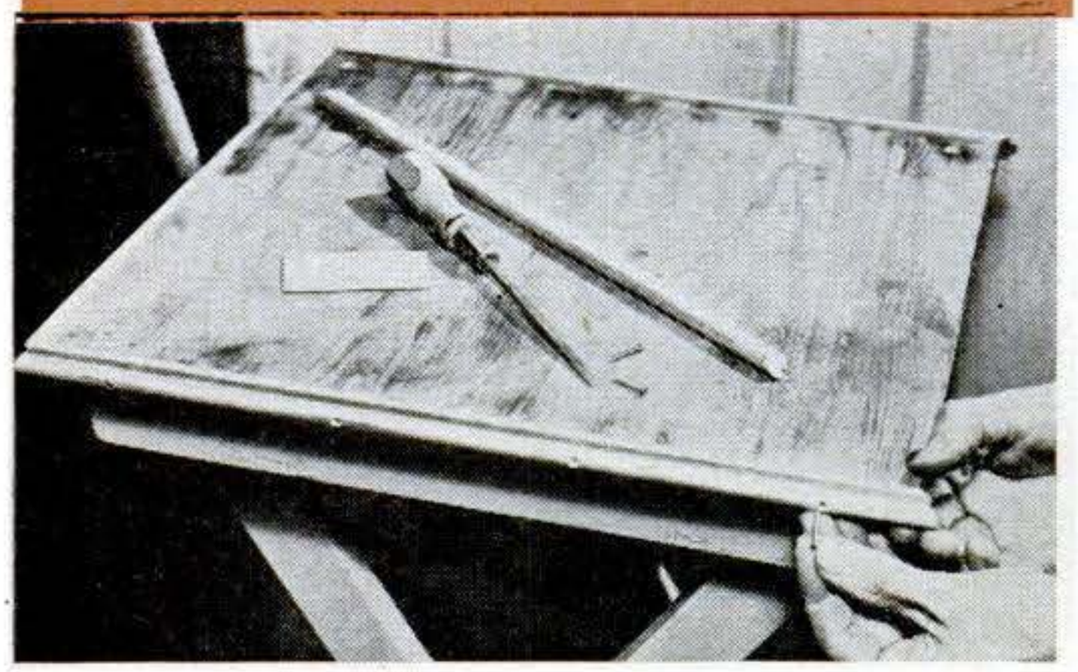


Aluminum edging and a plastic top transformed this small folding table into an attractive piece of furniture. Flush molding was used.



Guided by strips of adhesive tape, hacksaw blade cuts hard-pressed, laminated sheet plastic. Rough edges can be dressed smooth with a file.





Fastening molding around table top. Thickness of this edging required mitered corner joints. Drawings show three types of molding.

How to Put Plastic Tops on Tables

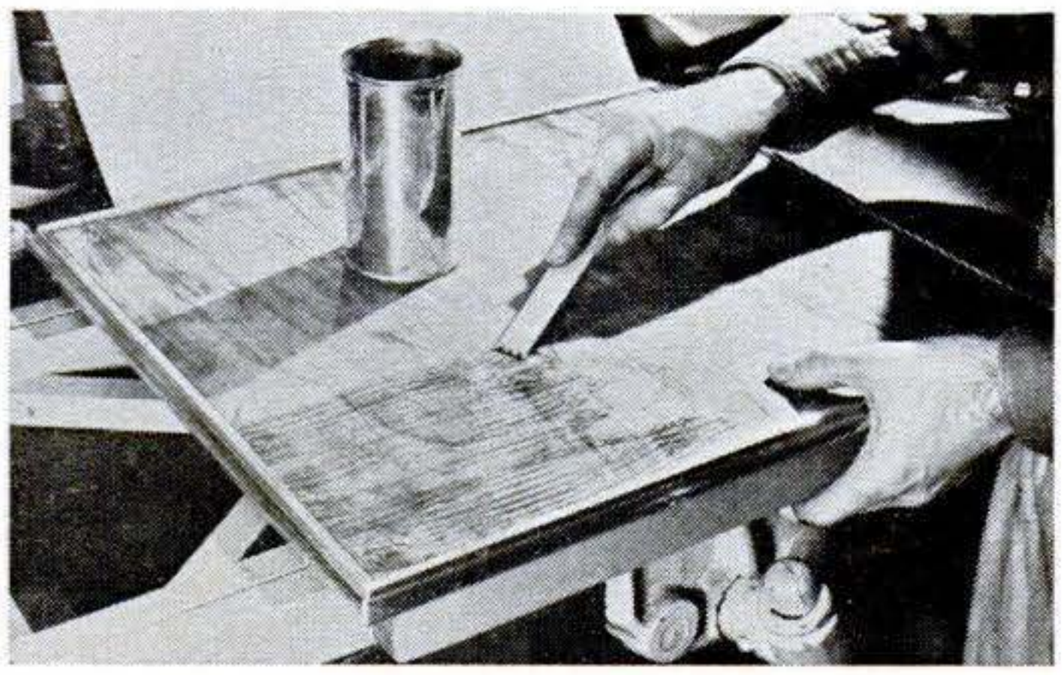
MODERNIZING old table tops is a snap with thin sheet plastic and either metal or plastic molding. Besides the covering material and edging, you need only a couple of simple tools to trim the plastic to size.

Use a hard-pressed, laminated sheet plastic—such as Micarta®, Formica® or Polatex®. This is the type widely used to cover tables and counters in lunchrooms. It has a high resistance to scuffing and scratching and is not harmed by most things that come in contact with table tops.

While you have a choice of molding styles, try to obtain the lipped type. It extends over the plastic top for a fraction of an inch and will help hold down the edges of the sheet. The molding on the table pictured at the top of this page wasn't this kind, but was a rather thick beaded strip. I mitered the corners because of the thickness of this molding. However, thinner metal can be bent around corners, particularly if they are rounded a trifle.

Flush-type molding can be installed before the plastic. Lipped molding should be fastened in place after the plastic has been applied but before the adhesive between plastic and table top has set. Of course, the bare table top should be flat and sanded smooth.

The plastic can be cut with a hacksaw and the edges smoothed with a rasp or file.



Glue is spread with paddle. Shallow notches in end of paddle leave glue in ridges that flow into uniform film when plastic is applied.

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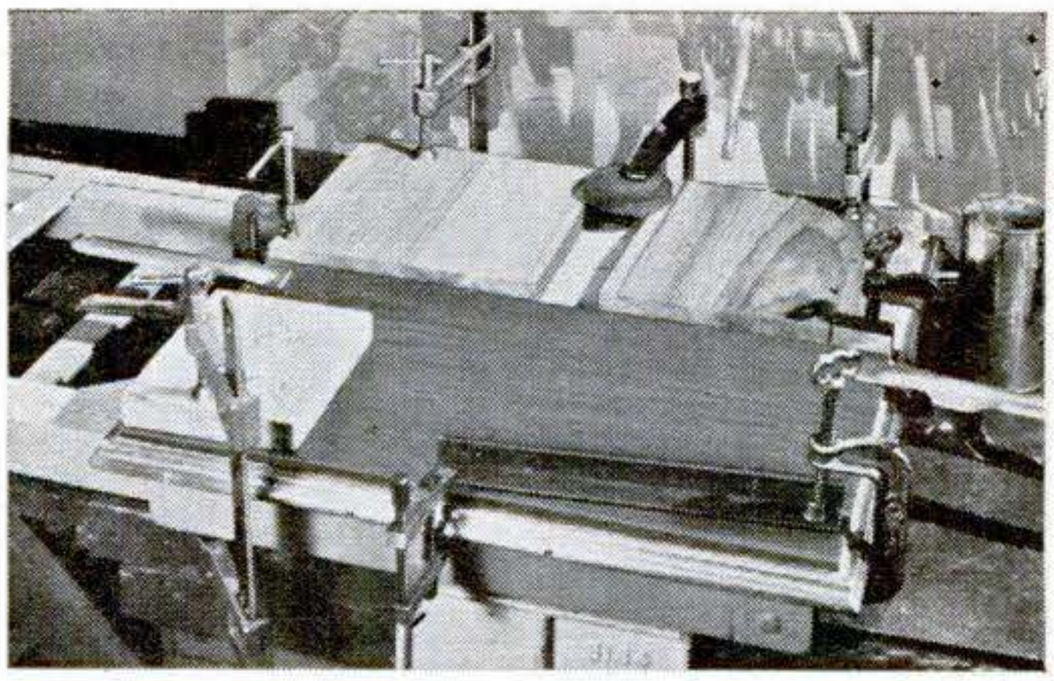
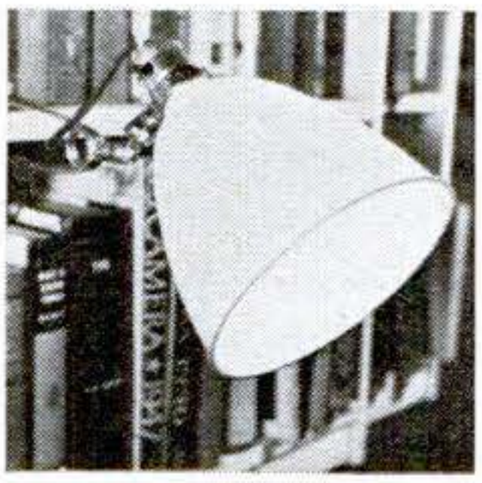
A block plane will cut down the edges faster than a file, but you'll have to resharpen the blade frequently. It's desirable to use metal-working tools because plastic tends to dull woodworking edges.

Anchor the plastic with casein, resorcinol, or phenolic-resin glue. Spread it smoothly over the top and lay the sheet over it. Apply clamps, or place weights on the plastic. Sandbags, concrete blocks, or buckets of sand will do as weights. Be sure the pressure is evenly distributed over the sheet. Leave the weights or clamps on at least overnight. *—Walter E. Burton, Akron, O.*



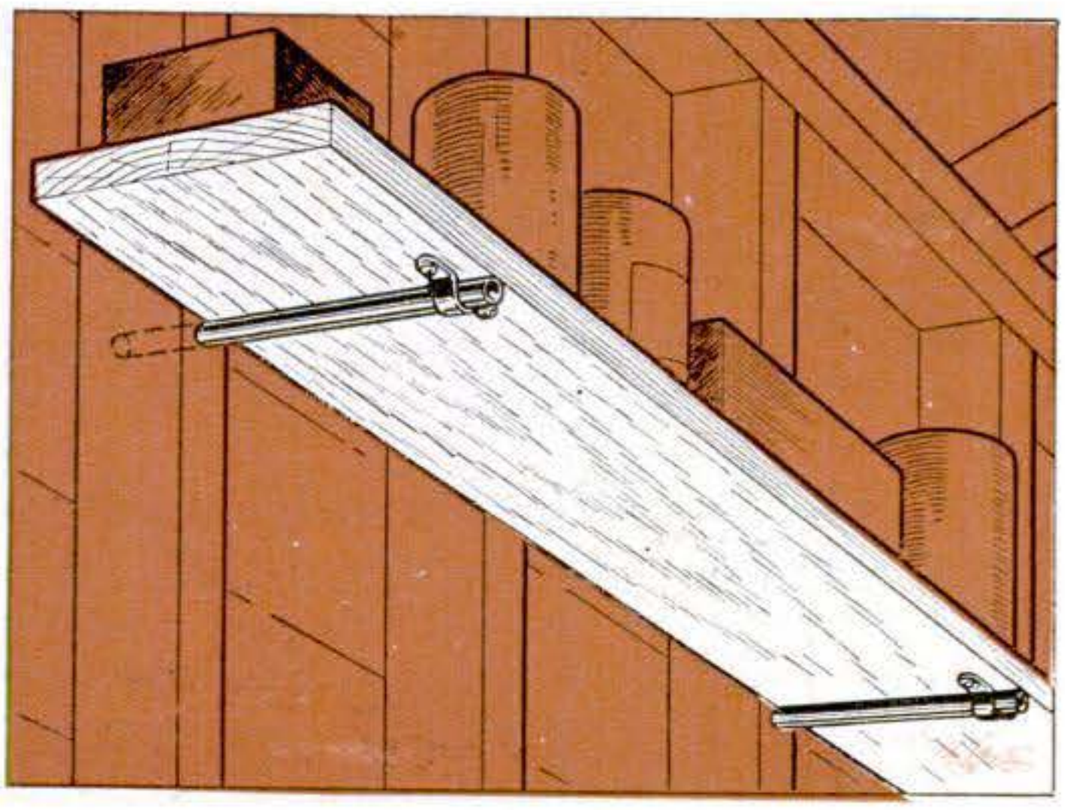
Tight clamping is important even if, as here, you have to use any available assortment of clamps. Weights may be substituted for clamps.

Reflector Makes Lamp Shade



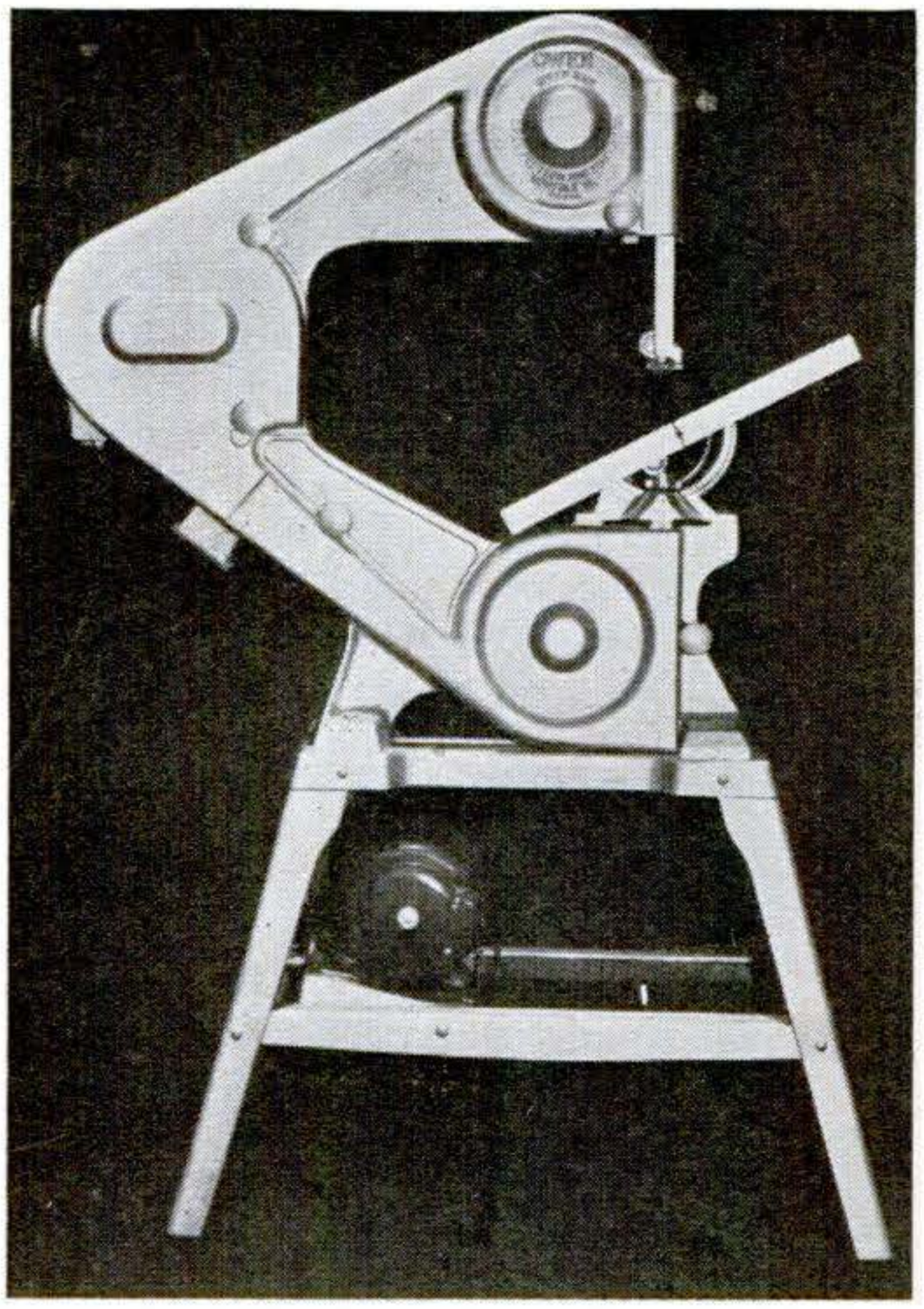
TRANSLUCENT plastic reflectors, intended for use in indirect-lighting lamps, can be made into attractive lamps themselves. Purchase the reflector together with a socket, cord, plug, and either a gooseneck and base or a spring clamp. You'll find that assembly consists mostly of wiring, since the reflector is already threaded for the socket. Such a lamp provides direct light for reading and a soft light throughout the room. *—Philip L. Cuskley, Boston, Mass.*

Pipe Supports Shelves



YOU can save yourself the expense of brackets for heavy shelves in the shop, garage, or attic by substituting pieces of old ¼" pipe. Cut the pipe to length and bore holes in the studding to take ends of the pipe sections. The shelf may be fastened to the pipe with metal straps, as shown in the drawing. *—Victor H. Lamoy, Upper Jay, N. Y.*

Deep-Throat Bandsaw



THE unusually deep throat—18¼" from blade to frame—is a feature of this bandsaw manufactured by the Owen Pattern & Foundry Co., Norfolk, Va. It's made possible by a third wheel and a triangular blade span. To permit unusually acute angle cutting without reversing the layout, the table may be tilted 30° inward and 45° outward. The skip-tooth, metal-cutting blade, moving at 3,200′ per minute, cuts wood up to 8" thick and metal to 2½" thick. Plastics also may be worked on the saw, which operates on a ½-hp. motor. A bench model, less motor, is priced at $297.

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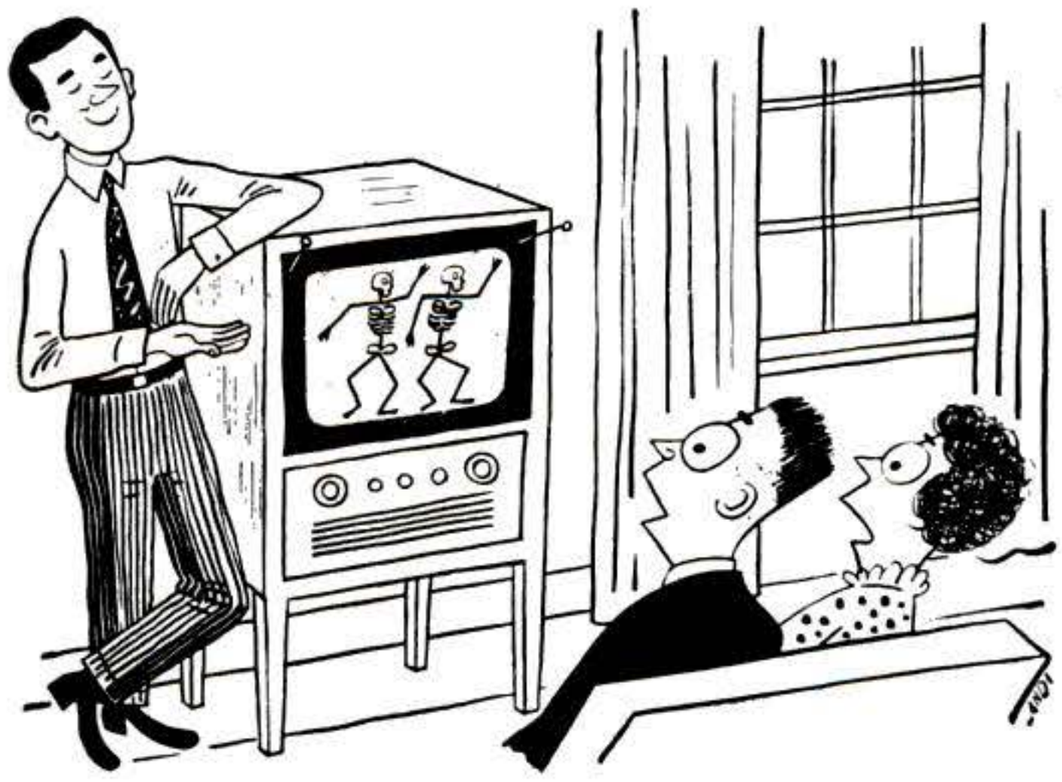
What's Your Ingenuity Quotient?



Those two skeletons you see doing a snappy tap routine on my television screen aren't really there. What happened was that our television set had so much glare that even free-loading guests were demanding sunglasses. Since the set already had set me back a nice piece of change, I didn't feel like laying out more dough for a filter. Instead, I bummed a big undeveloped X-ray film from a lab and dunked it in hypo to clear the emulsion. It has a nice blue tint that's fine as a filter.—*John H. Wilmes, Chicago.*

I wasn't hunting ground squirrels when I fired down the well. The reason was that our fishing-club's water supply ran out when the well mysteriously went dry after years of service. I removed the pump and fired several rounds from a .22 rifle down the 30-foot casing. That blasted holes in the sand packed at the bottom. Now the well gives more water than ever before.—*W. J. Kaiser, St. Louis, Mo.*

Oil's well that ends well, but for a time I was stumped. The problem was to pump oil out of an underground tank to an elevated one—and I had no pump. Then along came the ice-cream man. He didn't have a pump either, but what he did have turned the trick. I stopped up the vent of the buried tank and plugged its filler opening with a pipe fitting. The pipe inside this ran from near the bottom of the buried tank up to the elevated one. But first we dumped some pieces of dry ice from the ice-cream truck into the lower tank. As the carbon dioxide was released, it built up pressure that forced the oil up through the pipe.—*R. C. Harrington, Kingsport, Tenn.*

My car needed work underneath, and I couldn't see myself doing the job flat on my back. I took the doors off the concrete-block bulkhead and used it as a ramp.—*R. E. Tibbetts, Worcester, Mass.*

Have you pulled off a smart one lately? We will pay for acceptable contributions showing ingenious solutions of problems in the home, shop, garage, or camp. It doesn't matter if it's wacky—if it works. Use government postcards only. Contributions cannot be acknowledged or returned.

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Ins and Outs of Scrollsawing

For intricate cutouts the jigsaw is in a class by itself. And it's versatile enough to handle many other jobs.

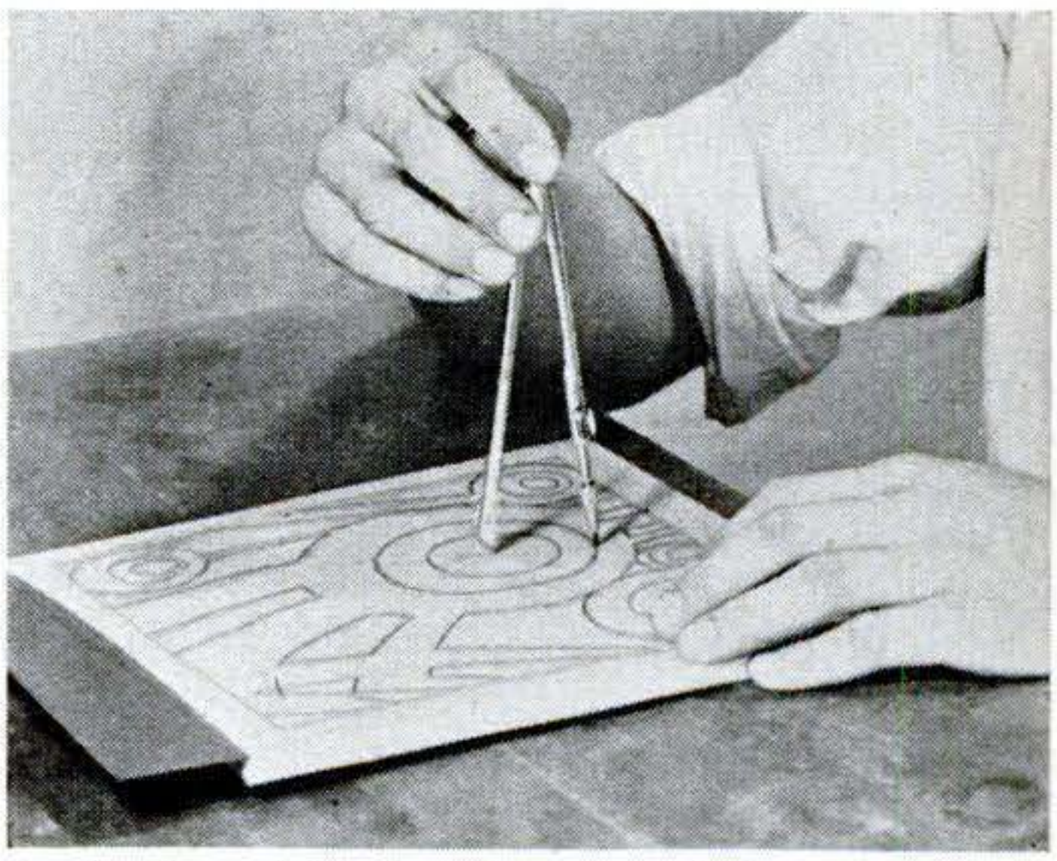
By Edwin M. Lore

GENERATIONS of craftsmen have entertained themselves with sawing lacework projects from thin wood, using hand-powered saws. Though ornate work seems to have gone out of fashion, the modern equivalent of the old bracket saw is gaining popularity in the home workshop. Besides hurrying the production of such traditional pieces as what-not shelves and saw-pierced boxes and grilles, the motor-driven jigsaw has opened new challenges to your skill in making plaques, silhouettes, and heavier projects such as signs made of cut-out block letters.

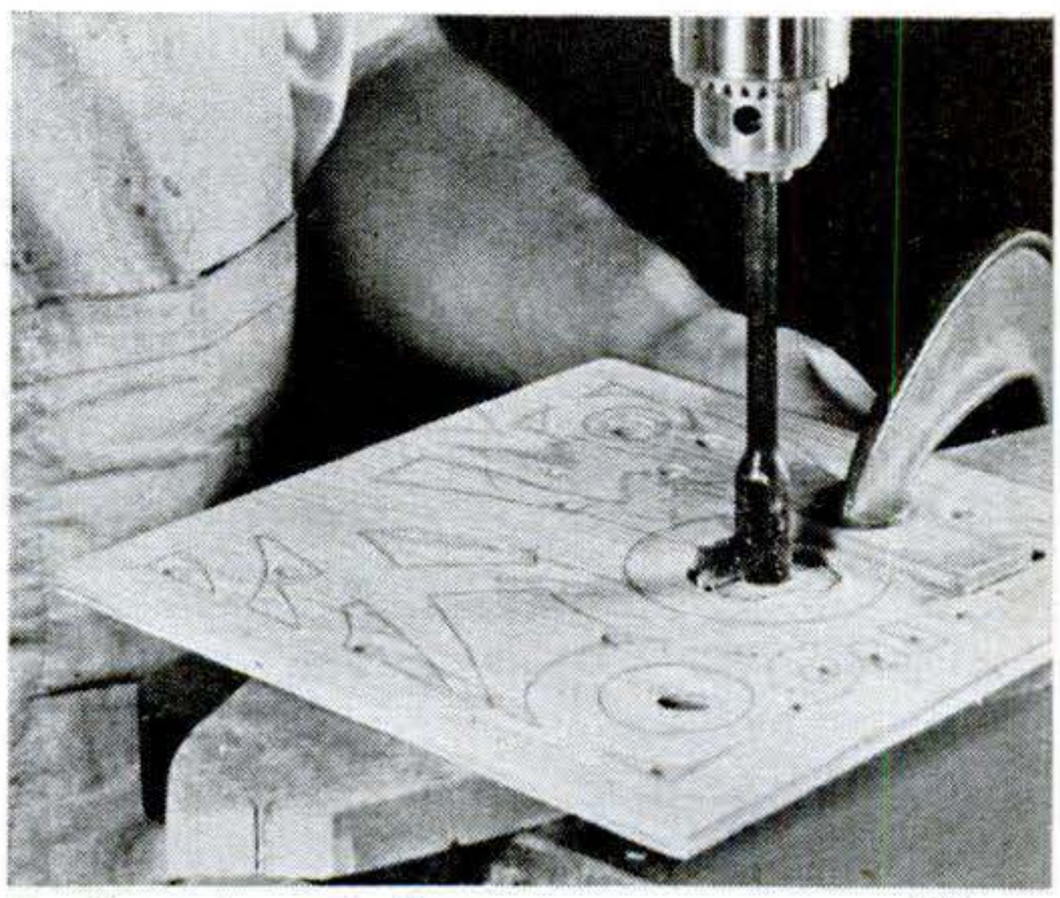
Solid wood is still good for many jobs, but plywood and grainless composition boards are tops for intricate cutting. Equally useful are plastics and the softer sheet metals.

True scroll cutting is an extension of the methods used in cutting circles with the jigsaw described in a previous article (PS, Sept. '48, p. 202). Add a few extra tricks for getting around corners and saving time, and you are equipped for any kind of design that comes along.

Laying out the work usually consists of tracing an outline pattern onto the piece to be cut. Many times you'll obtain full-size patterns that can be traced off directly with



1. Make a full-size drawing of the pattern and trace it directly on the work with carbon paper. Use a compass to make a radius or circle.



2. Complete circles are easy to cut out. If you use an expansive bit in the drill press, make sure the work is clamped down securely.

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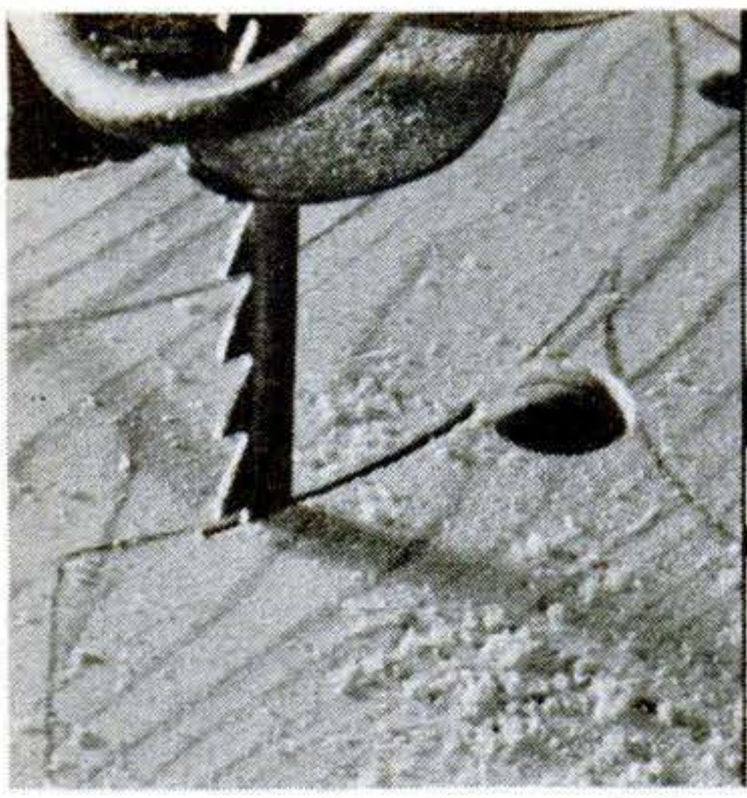
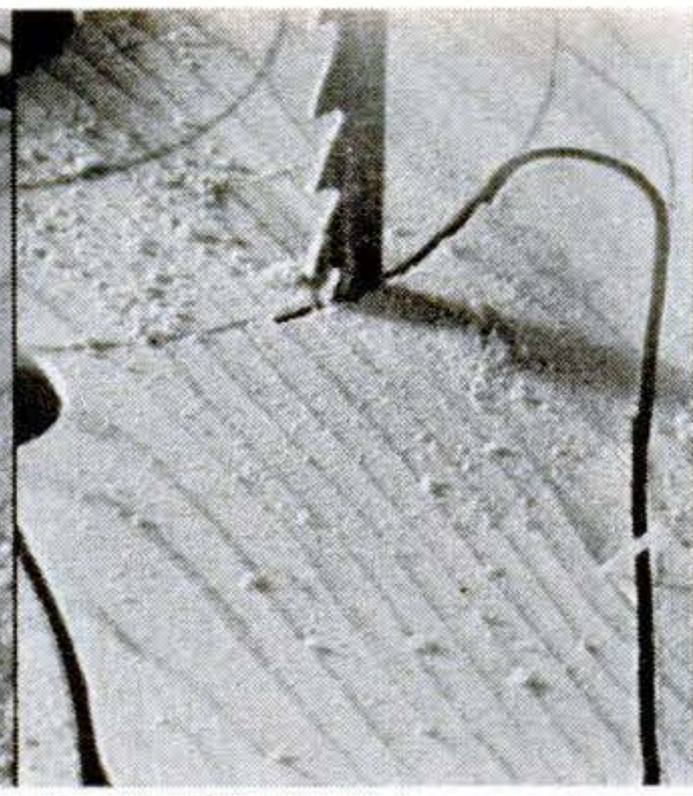
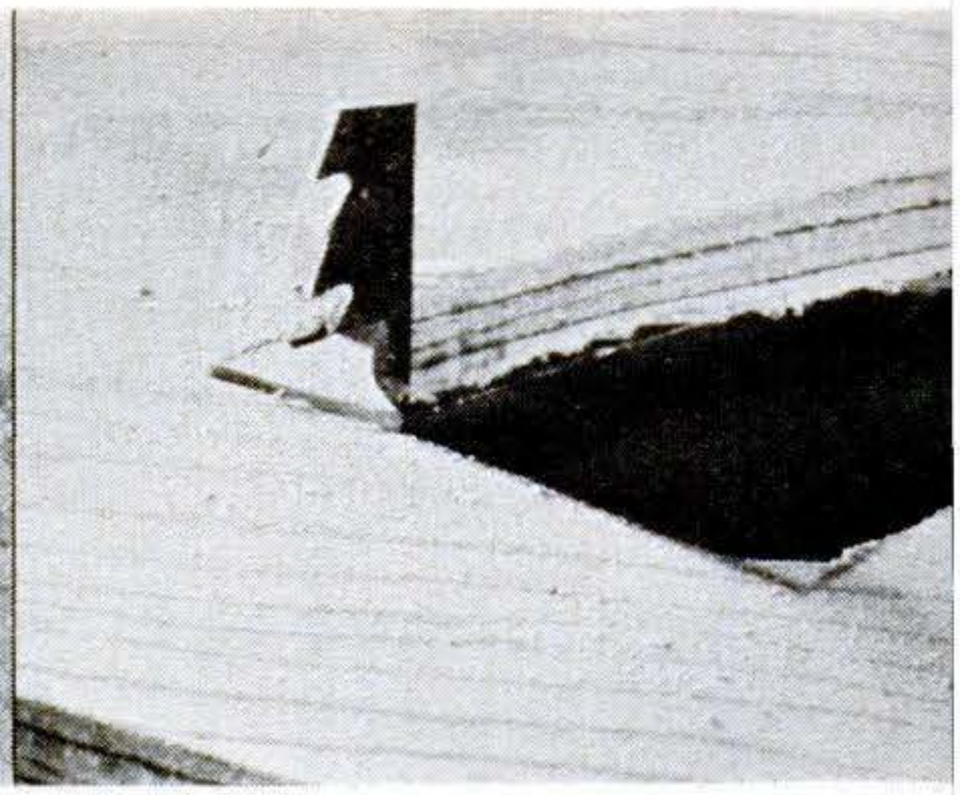


3. An accurate starting hole drilled tangent to two lines allows the saw blade to strike out along either side.



4. Before reaching a sharp corner, swing around and cut back along the adjoining line. Trim away the waste.



5. Then it's easy to come back and cut to the corner first from one side and then from the other. Be careful not to overcut.

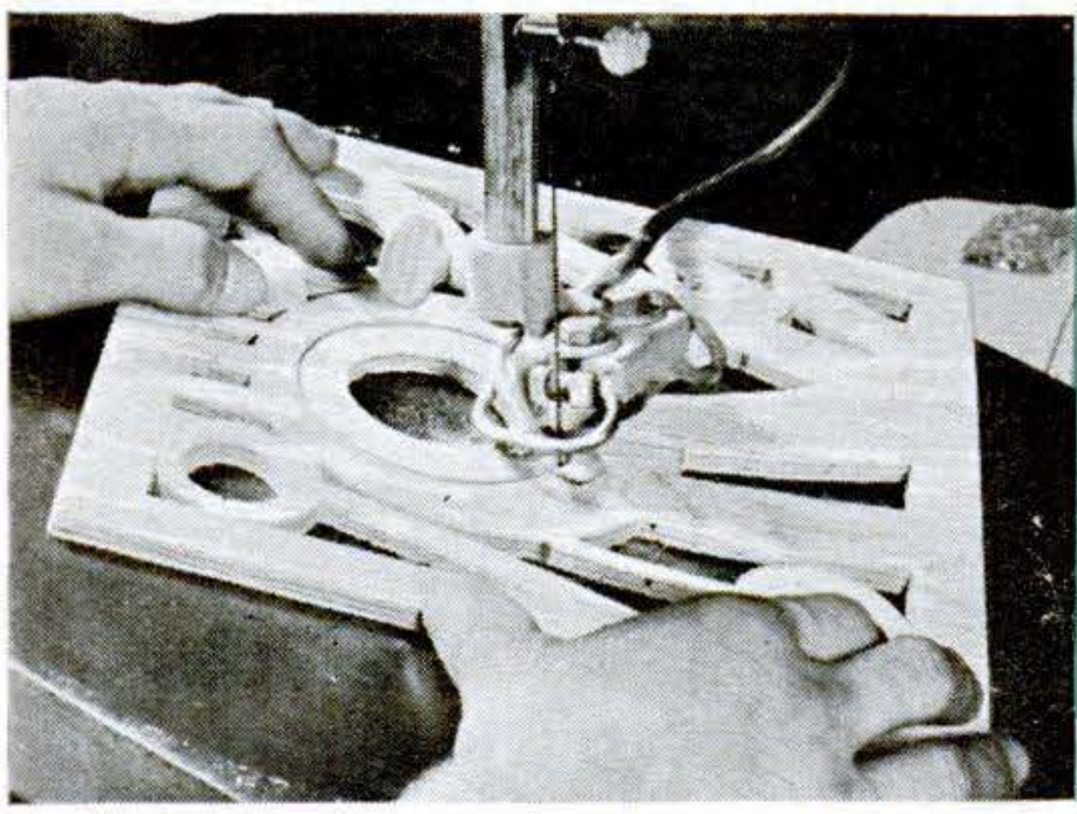
carbon paper, as in Fig. 1. To enlarge smaller designs, draw a grid of squares through the part to be copied, make a corresponding set of squares to a larger scale, and copy the picture square for square. The easiest way to make a symmetrical outline is to fold a sheet of tracing paper down the middle and draw half the pattern on either side of the center line. Trace this off, then flop the paper over and repeat the half pattern on the other side. A template is good when you have to copy the same pattern repeatedly.

Holes must be made to admit blades to inside cutting lines. When the cutout is a complete circle, you can use an expansive bit and eliminate sawing altogether. If you do, make sure the work is clamped down and take it easy to avoid splintering.

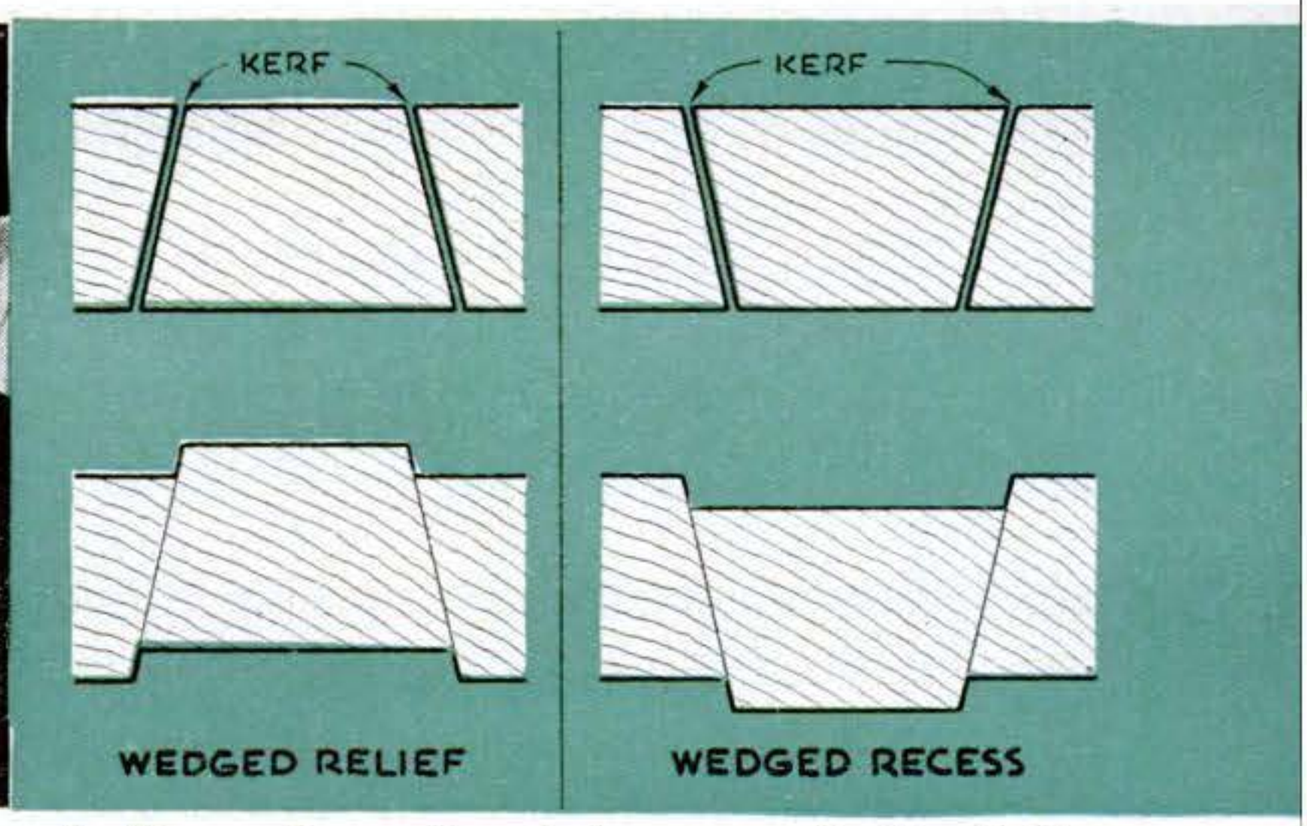
More often you'll make room for the saw blade by drilling small starting holes. Locate several of them in the waste near the line. So long as you stay in the clear, no great accuracy in location is needed. Better still (but requiring more care) is a hole that lies tangent to two lines (Fig. 2). Here the blade can strike out along either side. When the corner is an arc of a circle, a corner hole of corresponding radius does the triple job of giving you two tangent cutting lines and a clean, finished radius.

Whenever you can, use a saber blade—a stiff, fairly wide blade that is clamped only in the lower chuck. It saves time in removing and reclamping the upper end when changing holes. Larger blades cut faster and are easier to steer, but they will not negotiate sharp curves.

Work on either the left or the right of the hole, whichever is more convenient. To saw a sharp angle with a wide blade, scoot around a corner and come back on the opposite line (Fig. 4). After trimming away the bulk of the waste, come in from both



8. Sharp curves and small space call for finer blades that must be gripped in the top chuck as well as in the one below the table.



9. To make a beveled cut, angle the table. The cutout can be wedged into the hole either in relief or recessed below the surface.

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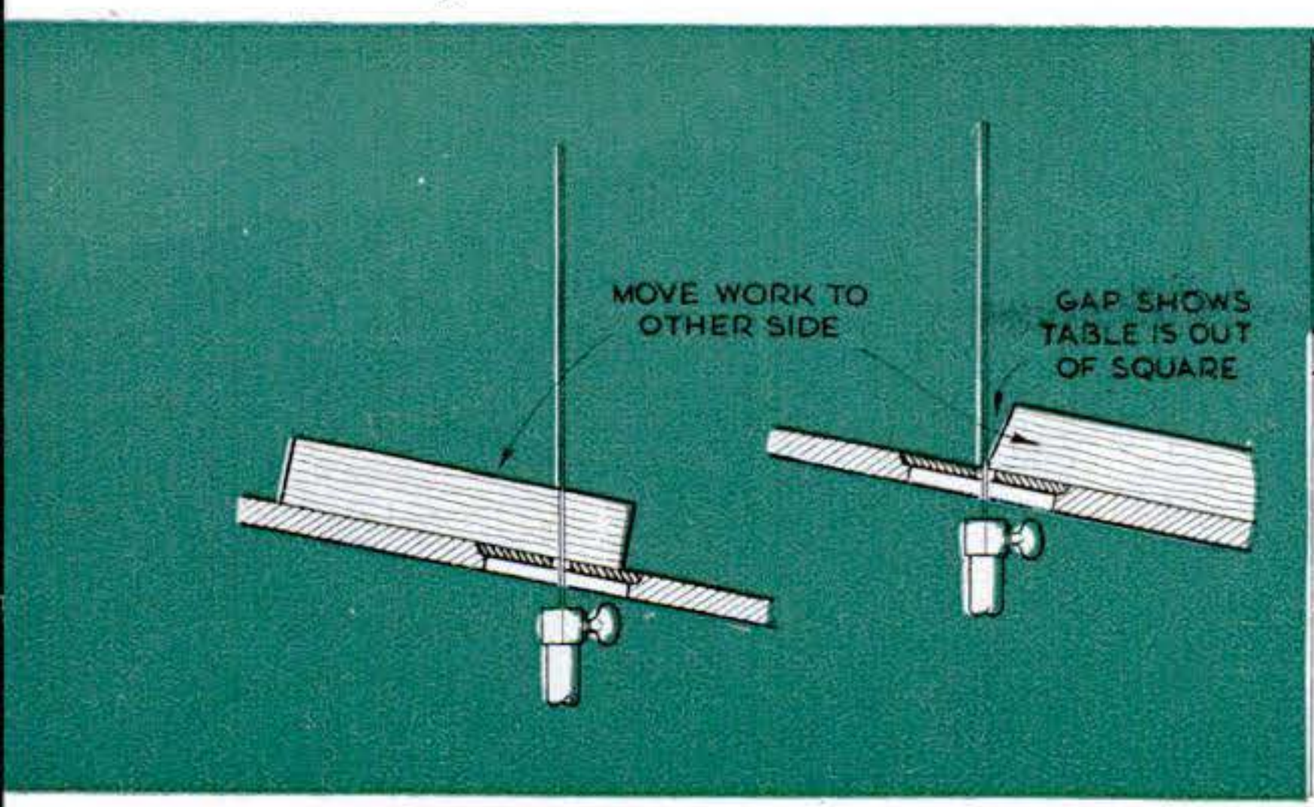
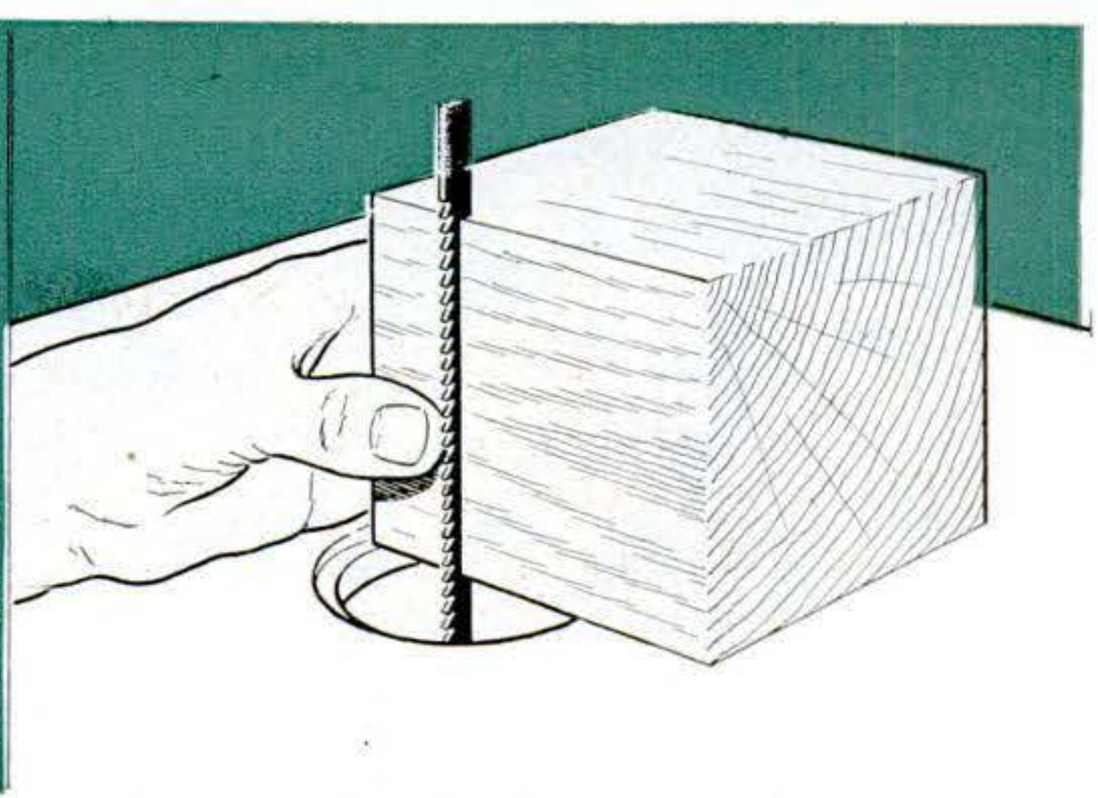


6. Test the table for squareness by taking a trial cut in scrap. Move the cut end to the other side and see if any gap shows. If the table is square, there won't be any.



7. Aligning the blade is also important, especially with saber blades that don't use the upper guide. The test block must have a squared base and a kerf exactly 90° to the base.

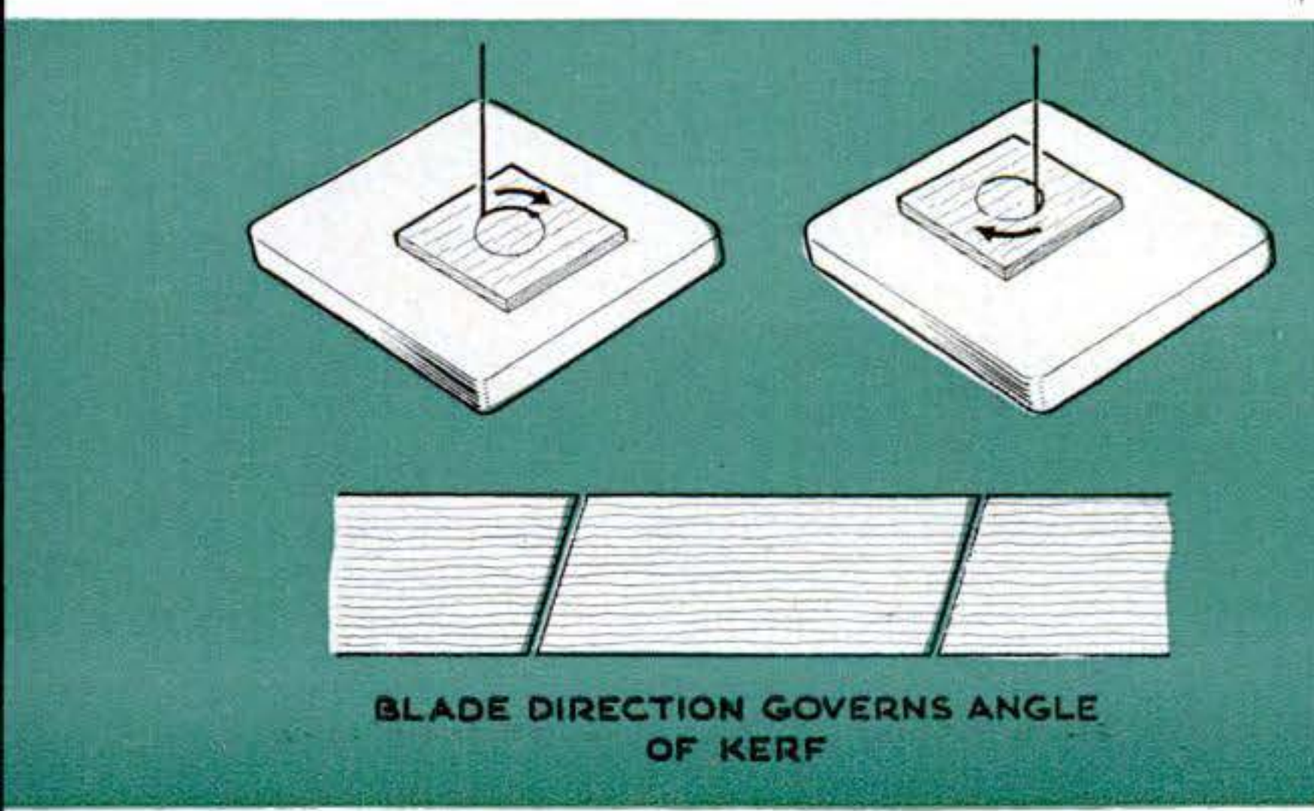
sides to the point or corner (Fig. 5). With a narrower blade you can follow one line right into the corner. Staying carefully in the waste, nibble out just enough material to form a turning radius for the blade, and then saw out of the corner along the other line. Small blades are required when the curves are sharp or the space is small. Chuck both ends with enough tension to prevent buckling on the upstroke.

In inserting a blade through a hole for an inside cut, some craftsmen prefer to loosen the upper chuck and enter the blade from the underside of the work. Others find it easier to clamp the blade first in the top chuck and thread it through the starting hole from above. With this second method it's harder to center the lower chuck.

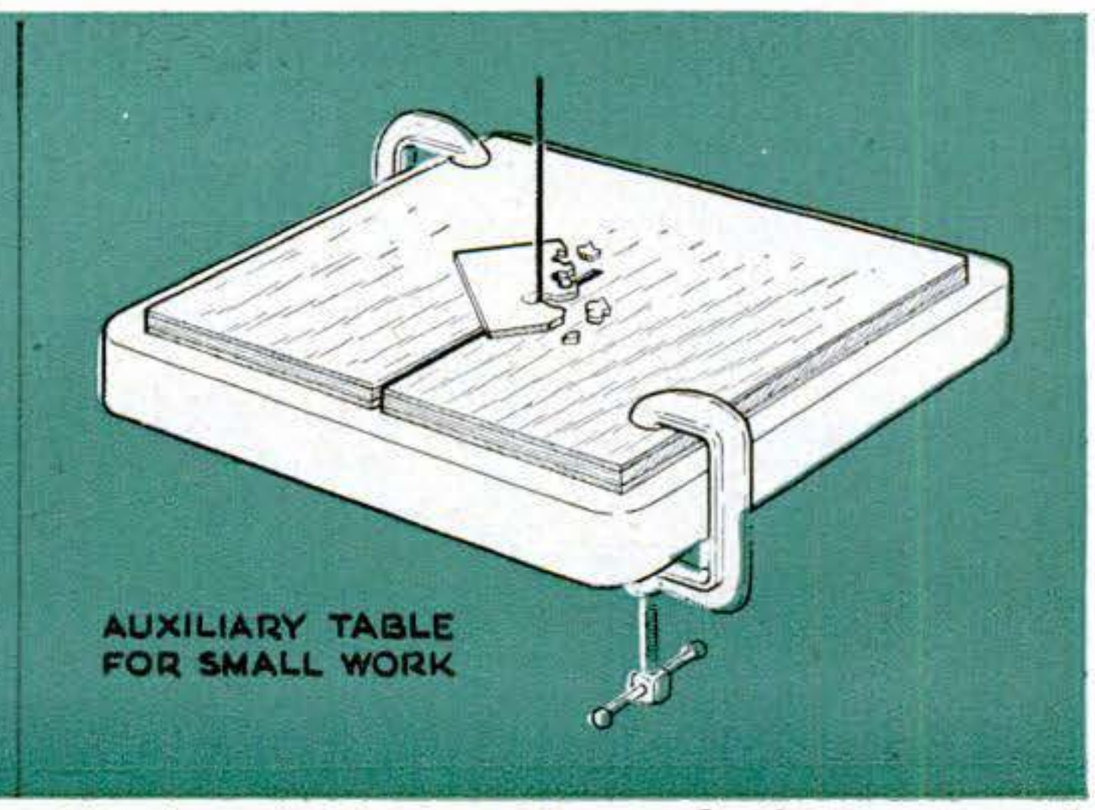
No matter how closely you follow the line, there will be many cases where your work will be wasted if the blade and table are not exactly square. The most obvious example is when you are making exact duplicates by cutting a stack or pad of thin pieces at one time. Any angle off the vertical will cause a noticeable difference in the size of the top and bottom pieces.

To check for squareness of the table, set it by eye and clamp it just tight enough to hold the setting. Make a test cut on a piece of scrap—preferably fairly thick stock. Move the cut end around to the other side of the blade and see if it squares up (Fig. 6). Using both the lower and upper blade guides will help in making square cuts. A jig for blade alignment is pictured in Fig. 7. Square the base of a broad wood block and saw a kerf exactly 90° to the base.

Fine blades are essential when you are cutting to a line that has no waste. Figure 8 shows such a case. The piece being removed will later be pushed into the opening until it is wedged. Here it is imperative that the cut *not* be square. Tilt the table



10. In order to wedge the cutout, it is essential that the work remain on one side of the blade. Reversing direction spoils the effect.



11. An auxiliary table made from a smooth board will keep small work from falling into the blade opening. Clamp the board to the table.

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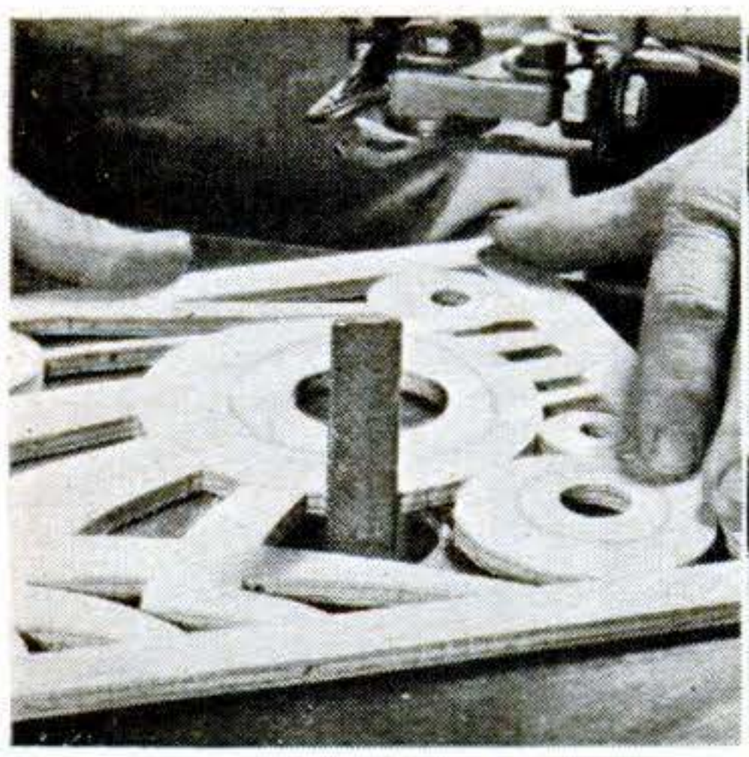
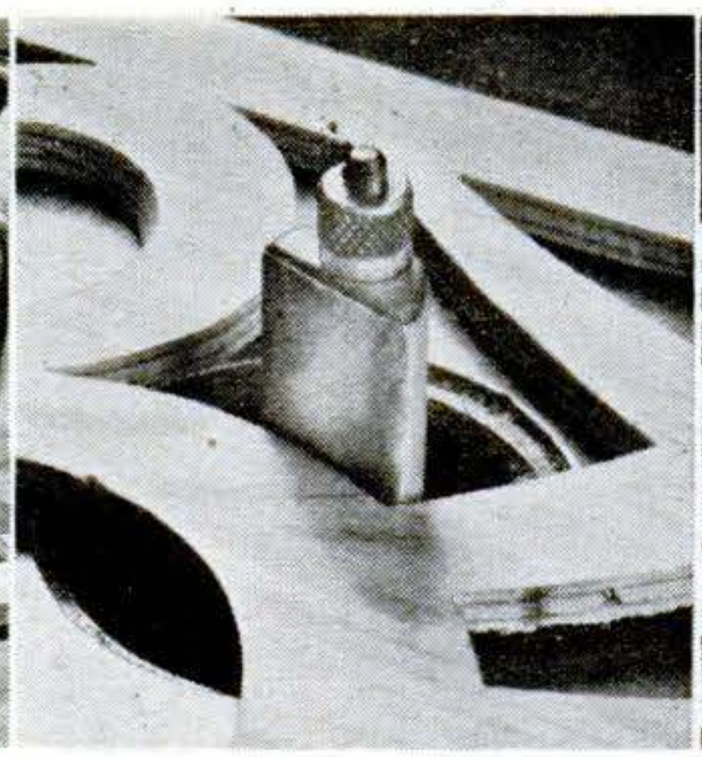
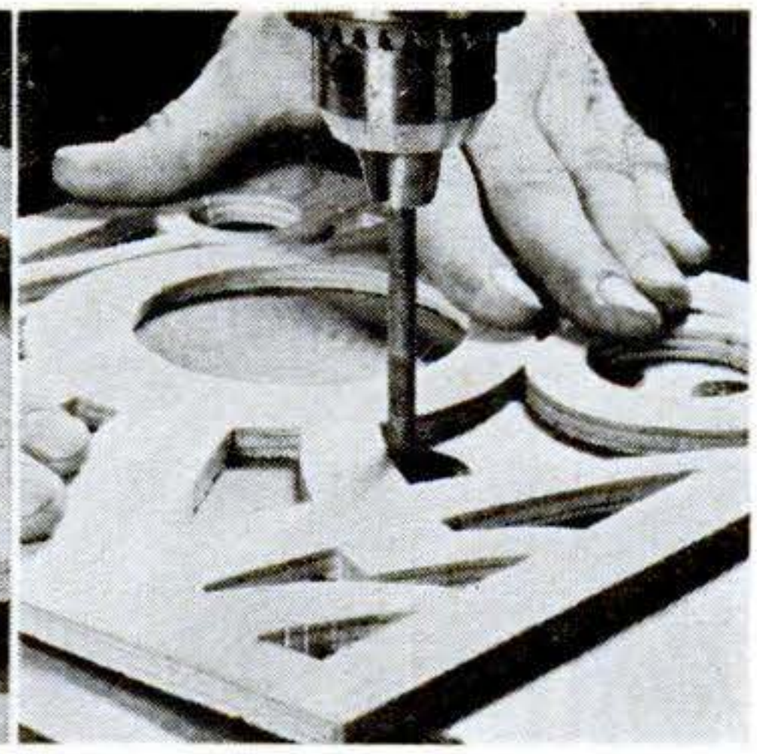


12. A broken piece of a cabinet file clamped in the lower chuck can be used to smooth edges. Cut the tang to fit.



13. Sanding attachments are even better. Nut on top tightens the sandpaper sleeve by expanding the core.



14. A round file revolving in a drill press is also good, especially on curves, but it won't get into tight corners.

and set the hold-down parallel, if it is adjustable. Bore the entrance hole at the same angle as the desired bevel, making it only as large as necessary to enter the blade.

The amount that a recessed or raised piece will project is determined by the angle of bevel and the thickness of the blade. The best way to determine this is by making test cuts in scrap. Figure 9 shows how the cutouts fit the holes.

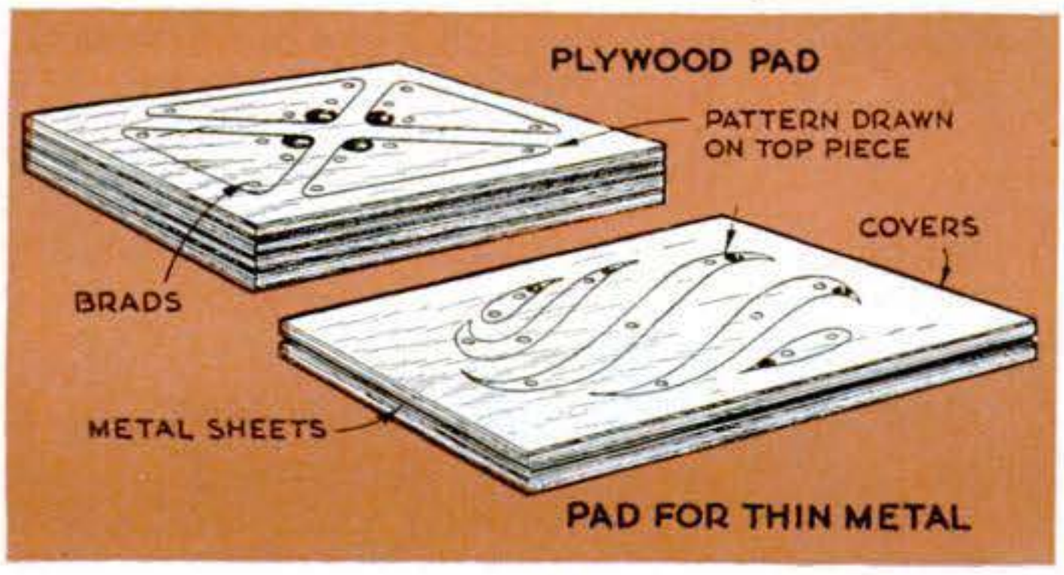
After establishing the bevel angle, the most important consideration in shaping a wedge is to keep the direction of cut uniform. It doesn't make any difference whether the work is on the left or the right of the blade so long as it stays on the same side throughout. The wrong way of doing this job is shown in Fig. 10, and a cross section of the resulting cutout makes it clear why the piece can never be wedged.

Jigsaw blades are always inserted with the teeth pointed to cut on the downstroke. On very small work such as brooches, pins, and novelty cutouts, the blade may tend to drag small pieces into the blade opening in the table. To avoid this, make an auxiliary table (Fig. 11) from any large, smooth piece of wood. Composition board is particularly good for this purpose. Run it partly into the blade, clamp it down, and use it as a table for delicate work. In time the saw will chew away the opening, making it larger than you want. No matter. Simply cut in another inch or so to make a brand-new opening.

Much of your scroll-saw work will come from the blade so smooth and true that no edge sanding will be necessary. Where it is needed it can be done efficiently by chucking a broken piece of a cabinet file, as in Fig. 12. Grind the tang and sides to fit the chuck. If you have one, a sanding attachment (Fig. 13) also will do the job. A file used in a drill press (Fig. 14) works well except in tight corners. For the very sharpest turns, a strip of sandpaper or emery cloth can be drawn back and forth over the edges by hand.

It is in cutting identical pieces that the jigsaw shows its real mettle as a production tool. The best method for making duplicates is to stack thin pieces into a pad. Generally there isn't much to be gained in building the pile over 1" or so high. Nail the pad together at the corners and head over projecting nails. When using large blades, nail through every available cutout space or shavings may wedge the layers apart and cause splintering.

The padding method is usually applied when cutting very thin metal. Sandwich the sheet between layers of wood (Fig. 15). The wood keeps the metal from twisting and bending. Use metal-cutting blades, of course. If your saw allows any choice of speed, the lowest one is the best here. END



15. Pads of stock bradded together allow you to make identical cuts in a number of pieces. Sandwich thin metal in wood for rigidity.

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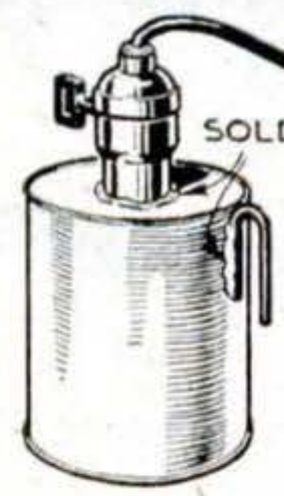
Adding Convenience to Your Jigsaw

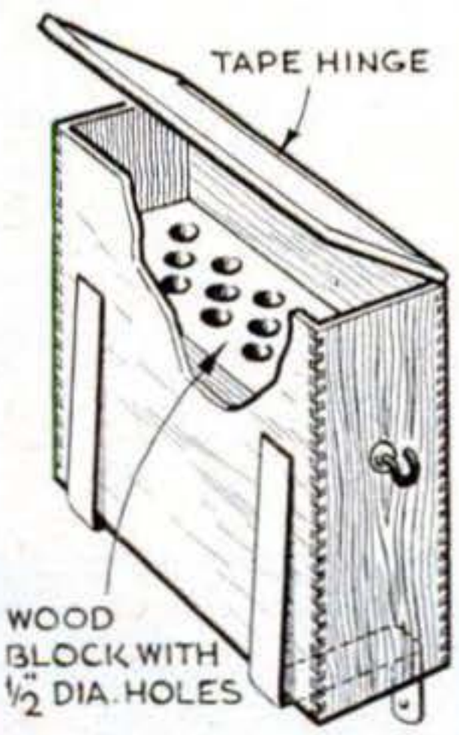
Simple helps give better light and control and keep accessories handy.

A GOOD part of the work done on a jigsaw is of the intricate, painstaking kind that calls for steady concentration. To make my work easier and more pleasant, I added the accessories shown here. No more shadows on the cutting line; no more groping for a switch or playing hide-and-seek with extra blades. The blade safe is a nailed-up cigar box with one end hinged.—*James W. Pierce, Valley Stream, N. Y.*

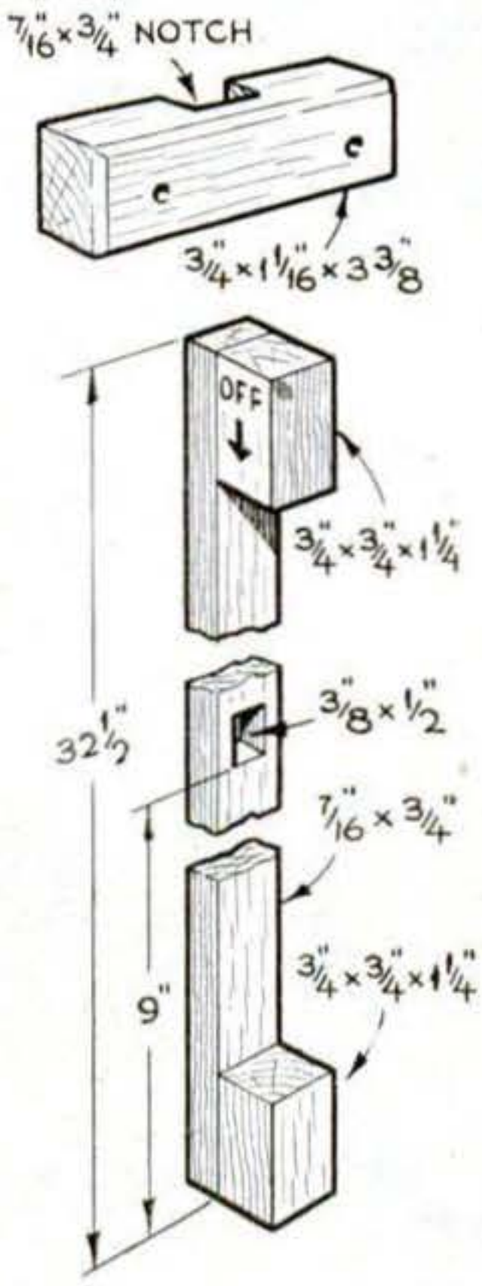


A tin-can reflector with a socket soldered in puts light on the work where you need it.

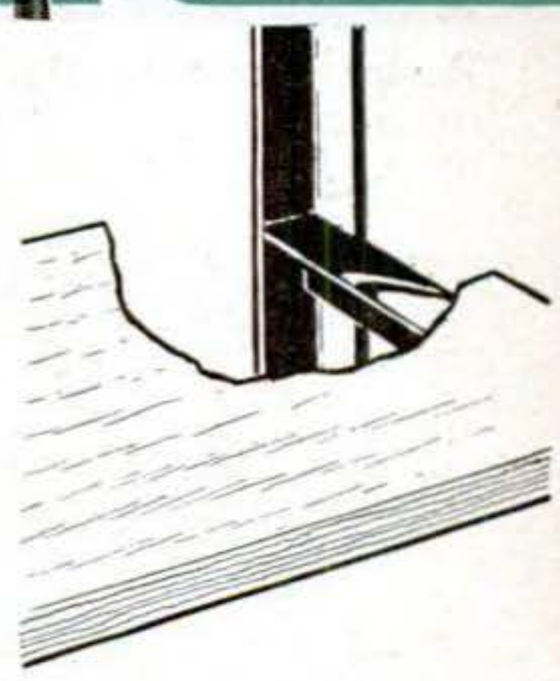
Guide for the lamp cord is brass rod bent and threaded. Drill and tap overarm to suit.



Blade safe is a cigar box fitted with drilled block. Hook on side holds chuck wrench.



Mount an outlet box and switch on lower shelf. Push rod in guides allows elbow or foot shut-off.

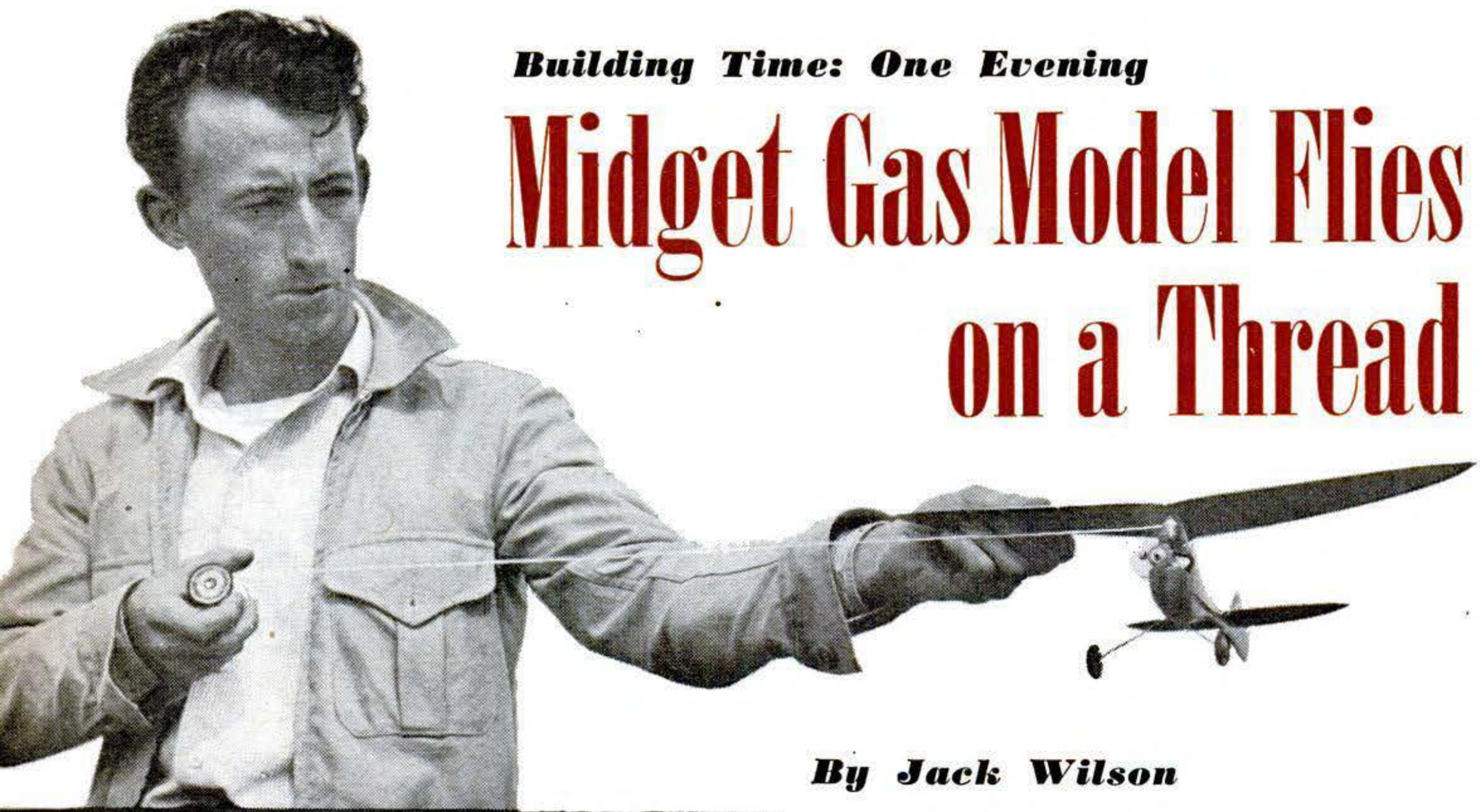


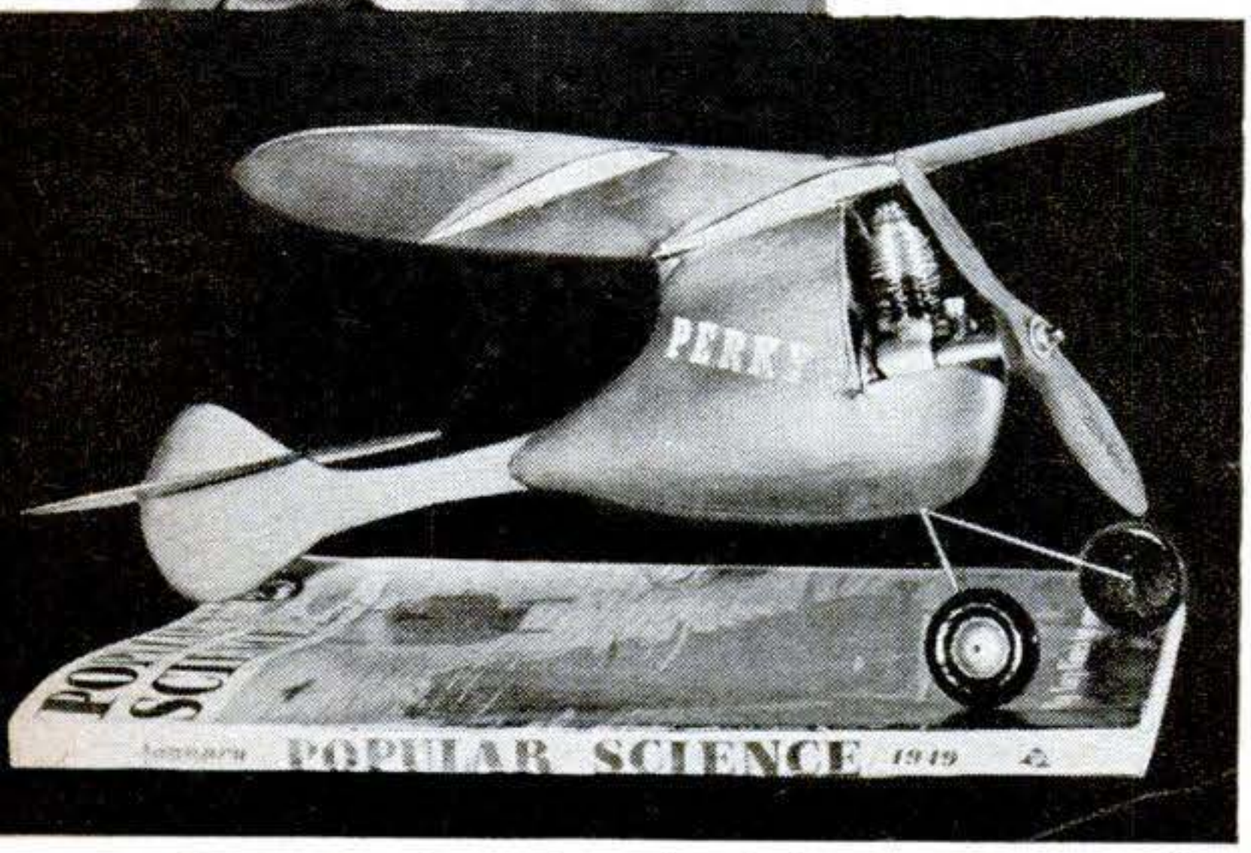
An extra shelf is supported by two lengths of angle stock. Bolt or weld them to legs.

Pieces of inner tube under the feet damp vibration and help to level the saw table.

Building Time: One Evening

Midget Gas Model Flies on a Thread





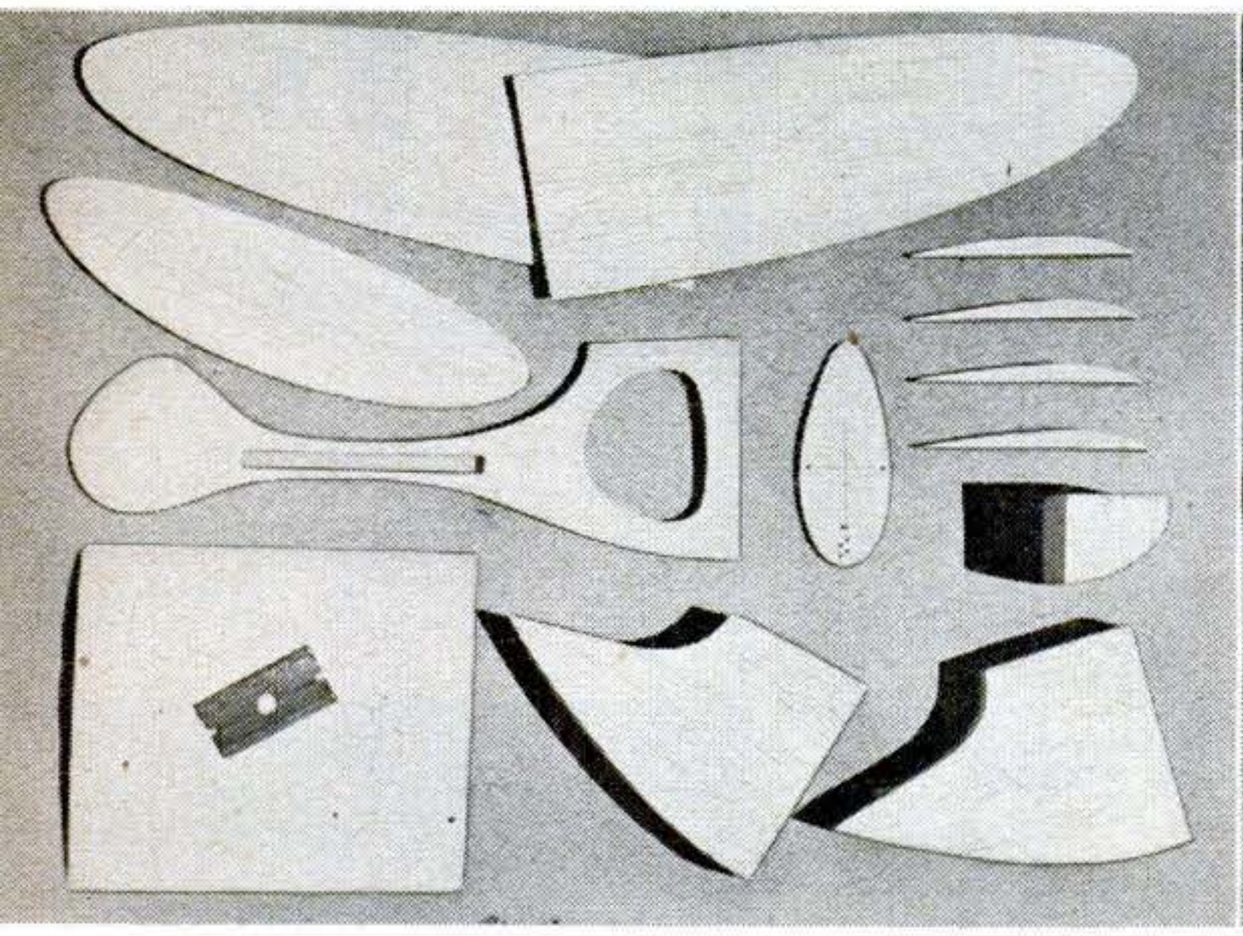
Perky is about length of this magazine you're reading. It has Infant Torpedo® engine, 5" prop, flies on tether inside or free outside.

By Jack Wilson

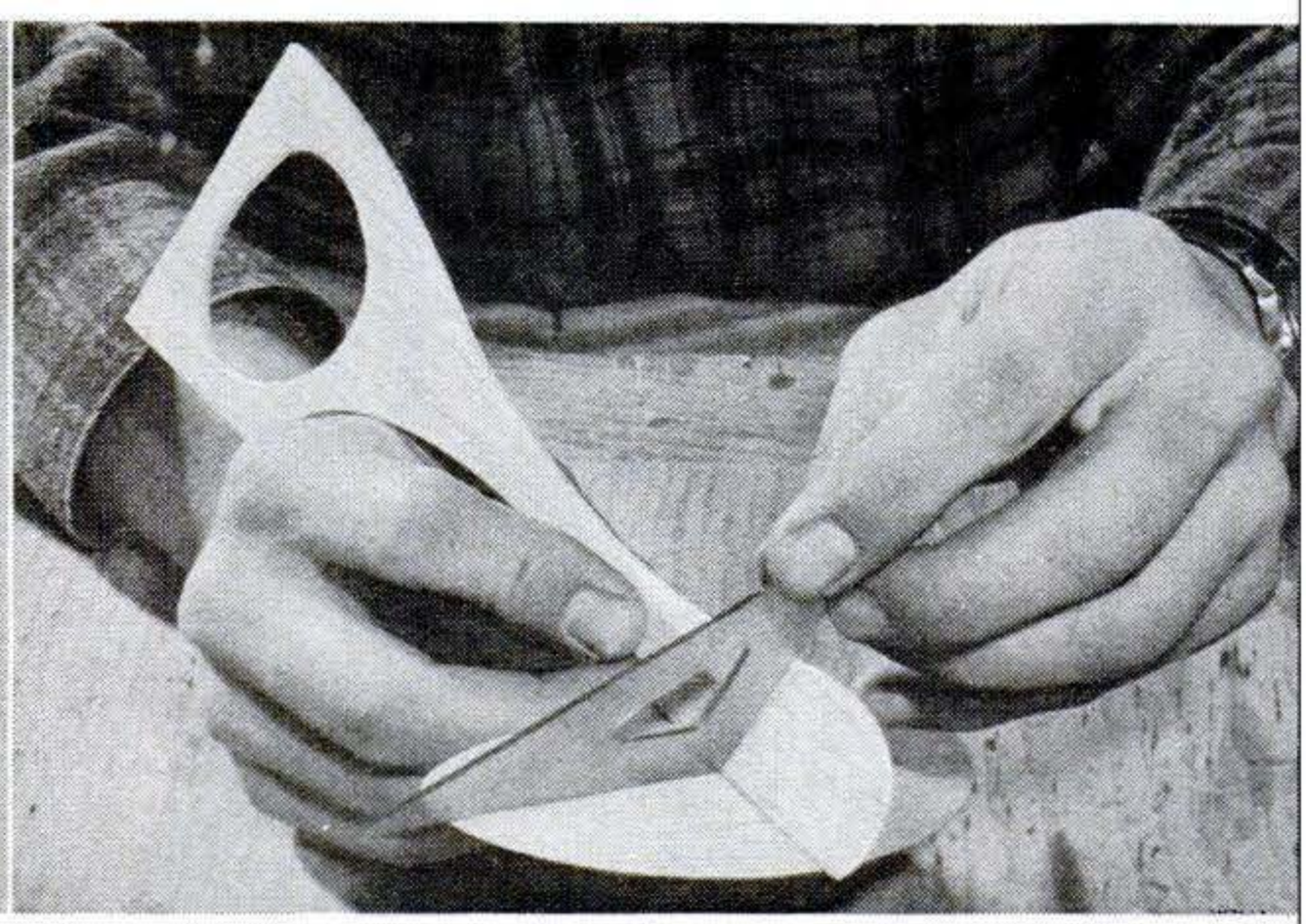
IF YOU'RE really cramped for flying space, Perky's the model for you. Ideal for tether flying indoors, it has a wing span of only 16". Ready to take to the air, it weighs just a trifle over 2 oz. This lightness greatly reduces the hazards of close-quarters flying, and means that a sturdy No. 40 thread can be used in place of a steel tether.

In the wide-open spaces, a spunky little .02-cu.-in., glow-plug engine spirals the ship up to 500′ in 20 sec. With the engine throttled back, Perky flies in wide, lazy circles, gaining only 100′ altitude during a full-tank run of one minute.

Simple but rugged balsa construction means the model can be completed in an evening. Five hours should finish it.



Twelve wood parts make up model. Cut these with razor blade, smooth with No. 0 sandpaper. Mark centerlines, rib positions with pencil.



Check alignment of stabilizer with triangle or square before cement hardens. Do the same for firewall. Slice tail fin to install stabilizer.

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Three versions of the basic design have been built—one with a solid balsa fuselage, one with the fuselage formed of 1/16″ sheet balsa, and one with the fuselage blocks hollowed to a 3/32″ wall thickness. The last version is the kind described here.

Full-size patterns are given on page 189. Trace these off directly on the wood, or make templates of thin cardboard. Be especially careful in cutting out the fuselage keel piece. It is the key to accurate alignment of engine, wing, and stabilizer.

For added strength, fit a basswood stiffener into the slot in the tail boom, cut a 3″ by 6″ piece from a nylon stocking, coat it with cement, and wind it around the boom. Slice off the top of the fin at the indicated line and cement the stabilizer in place.

Form a landing gear by doubling a 7″ length of wire and shaping as shown. Punch the holes and slot in the plywood firewall with a sharp ice pick. Push the wire "U" through the slot, pinch down against the wood, bind with thread, and cement well. Put a drop of solder on each axle to hold the wheel on.

Cement the firewall to the fuselage and the engine-mounting nuts to the firewall. Now lightly cement the cowl and fuselage blocks in position. Carve and sand to outside shape. When this has been done, pry off the blocks and hollow them out to 3/32″ thickness. Again cement in place. Be careful in carving the cowl to fit the engine closely.

In forming the wings, first cement ¼″ of each rib to the panel. When this cement has set, dampen the top surface of the panel and cement the ribs down. A scrap of wood between the clothespins and top of the wing will protect the surface.

When the ribs are solidly in place, dampen the top of the wing panels again and pin them to a flat surface until the wood has dried completely. Thin cardboard will prevent the pins from marring the wood.

After sanding the root ribs to give the indicated dihedral, cement the wing panels together. Finally, cement to the fuselage.

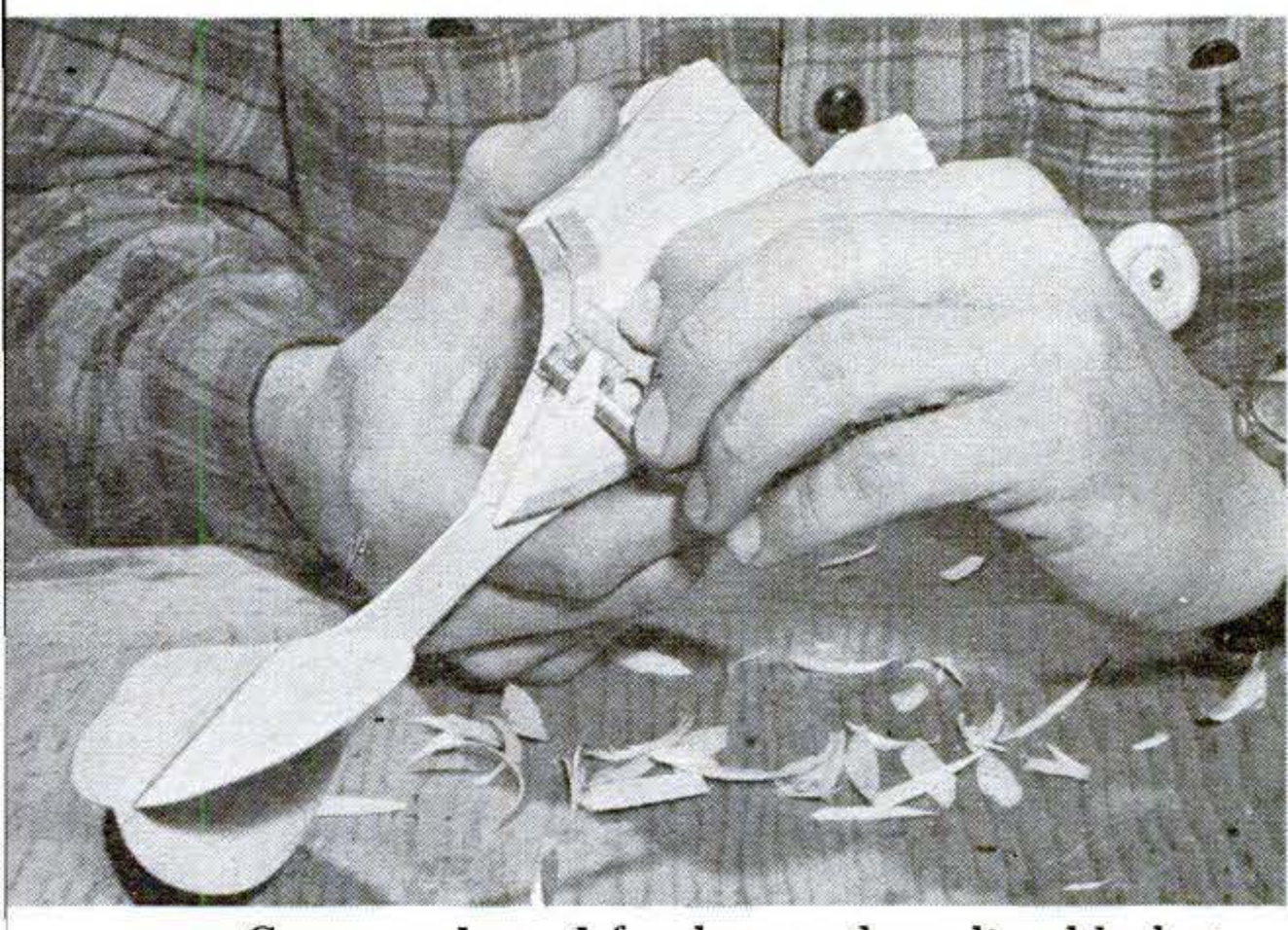
For a slick finish, apply a couple of coats of wood filler, brushing against the grain. Then apply a coat of clear dope, three coats of color, and two coats of hot-fuel proofer. Sand lightly after all but the last color coat and hot-fuel proofer.

You can make a satisfactory wood filler by mixing talcum powder or Fuller's earth with clear dope to the consistency of a thin paste. Use about two teaspoons of powder to four of dope.

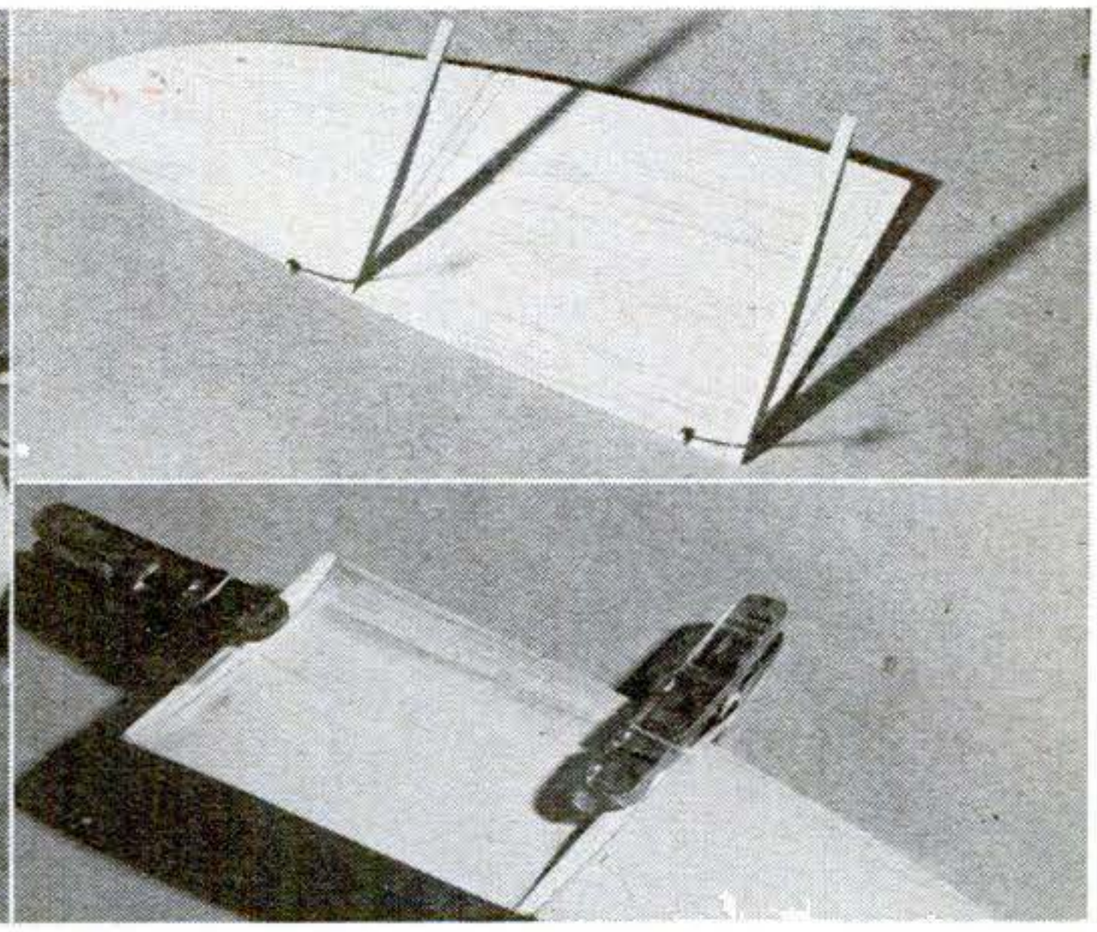
A combination flight timer and fuel cut-off device for short hops can be contrived by using a special 3″ fuel line. Just before launching, this is pulled from the tank pipe so that only the fuel held in the line is fed to the engine. This will keep it running about 15 sec.

The long line is stiffened by a spring made by wrapping No. 28 brass spring wire around a 1/16″ rod for a distance of ⅝″. Stretch the spring to 2″ length and push it into the carburetor end of the line.

Balance the finished plane at the wing roots ¼″ back of the firewall. Test-glide the plane cautiously at first, starting out over tall grass in calm weather. The model should glide fast and flat for 45 or 50 feet. There



Carve and sand fuselage and cowling blocks to streamline contour, with firewall as a guide. Hollow out blocks before final cementing.



Cement rib tips in place (top), pinning until dry. Then dampen top of wing, form to ribs, and cement, holding in place with clothespins.

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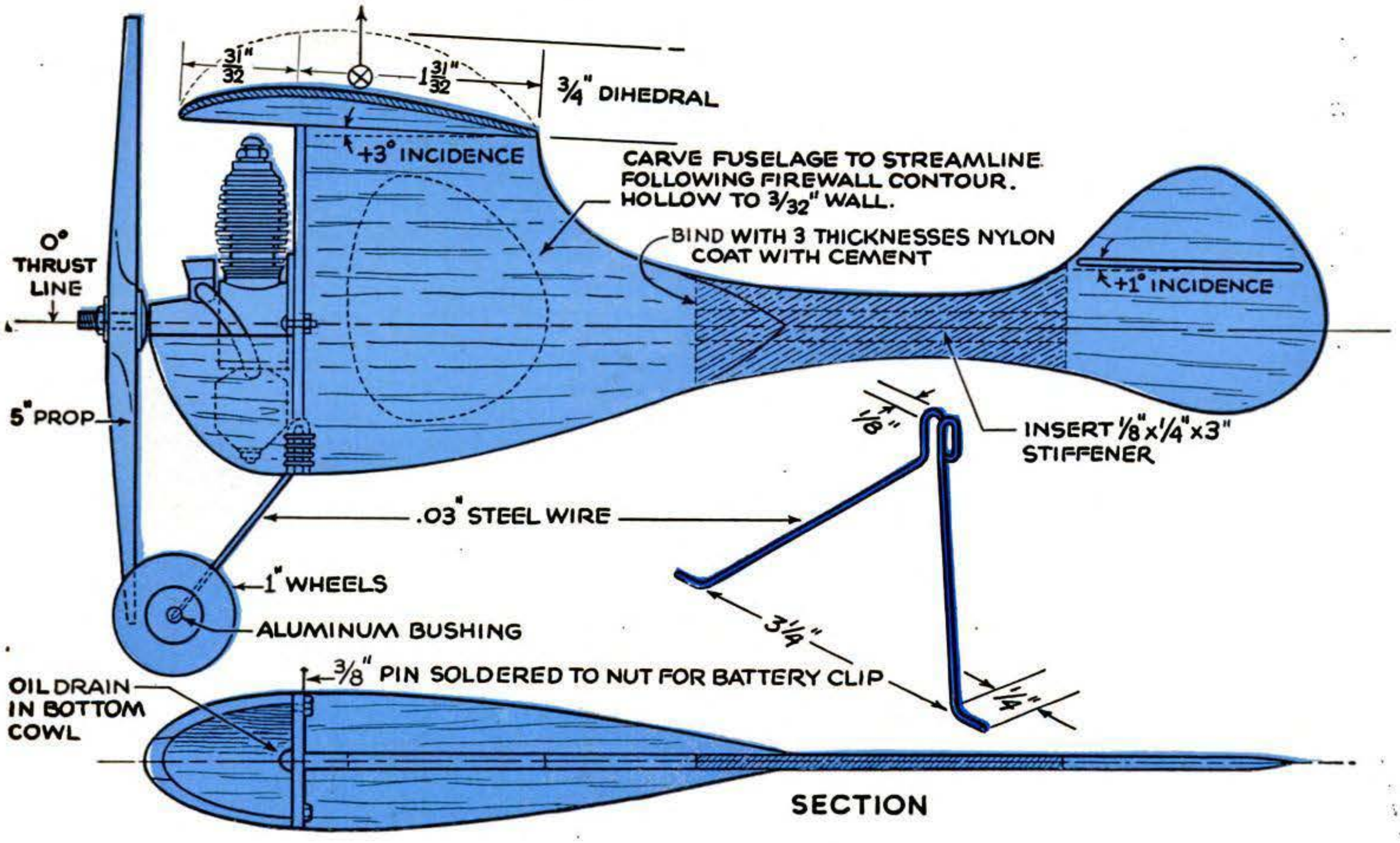


should be only a slight tendency to turn, since this will be increased with faster powered flight.

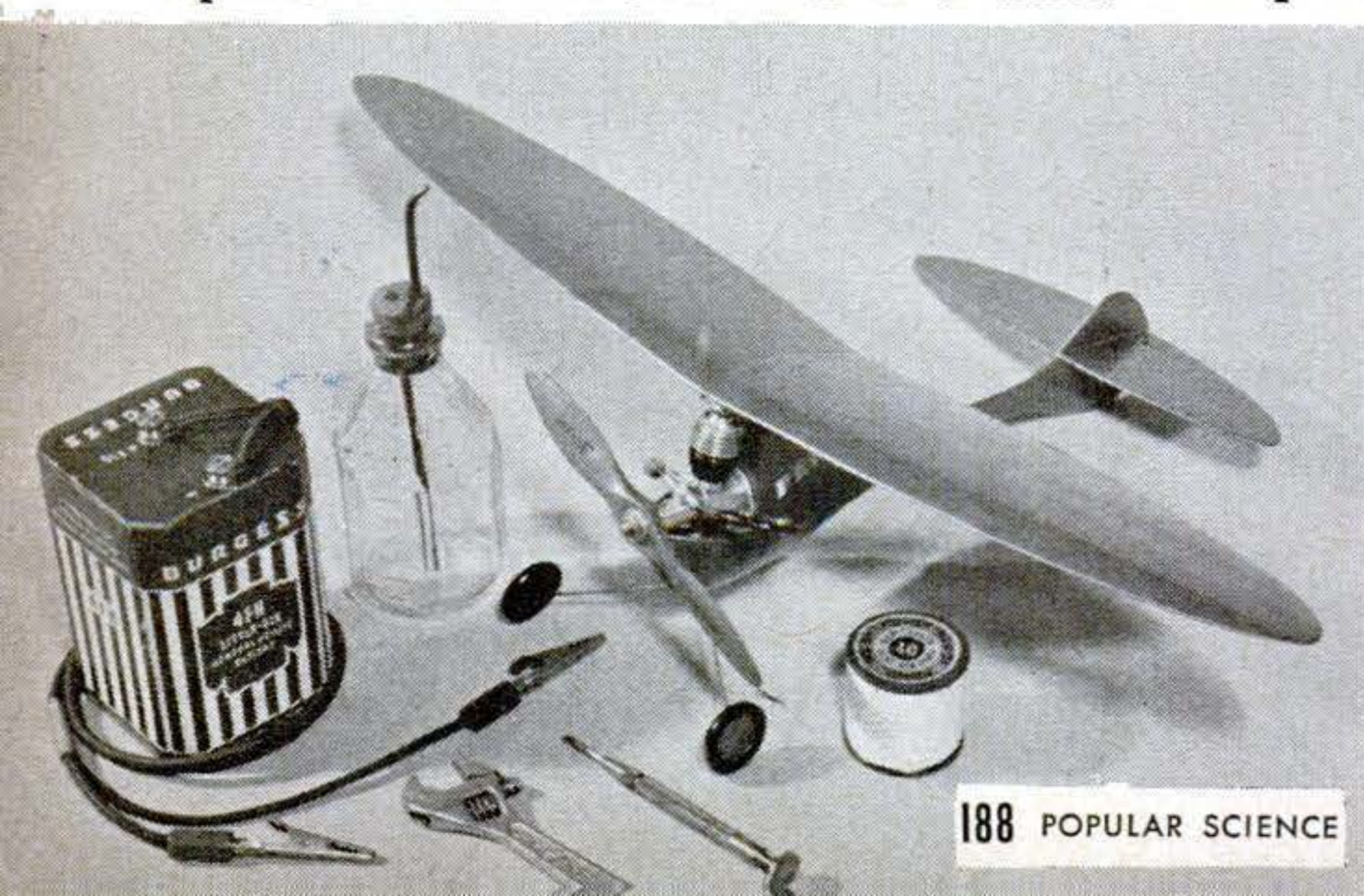
For the first power flight, hand launch the plane upwind with the nose straight ahead and the engine at its slowest speed. Use only a 15-sec. fuel supply. Throw the model with slightly less force than for the test glides. Shift the engine thrust line as necessary by shimming the engine up, down, right, or left with wood slivers. For all-around flying, it's best to retain the 5″ metal prop supplied with the engine.

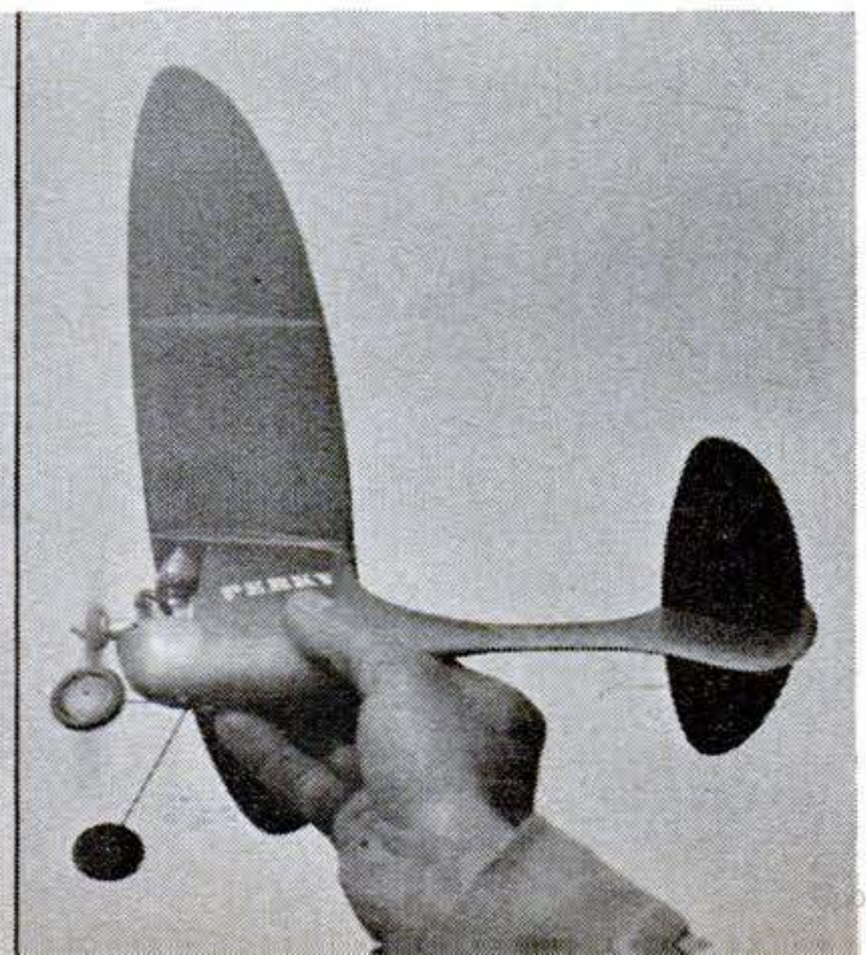
If you want to try tether flying, either do it indoors or wait for an absolutely calm day. Run a tether of No. 40 thread through the wing guide and tie to the fuselage under the wing roots. Try a few dry runs first by whipping the model around with a dead engine. The nose can be weighted to shift the balance to the leading edge of the wing.

Complete flying equipment is shown in the photo at the left below. The fuel container is a 4-oz. feeding bottle bought at a drugstore for about 15 cents. It is fitted with a cork having two ⅛″ holes, one for a breather tube running to the bottom of the bottle and one for the filler tube. The graduations on the bottle are convenient if you mix your own fuel. A second, plain cork prevents the bottle from spilling in transit. Clips on the starting-battery cables are staggered to keep them from shorting out against one another accidentally. END

Here's the kit for a flying session. The thread replaces conventional steel wires as a tether.

Aim the model straight when hand launching for power flight. It will fly about a minute.





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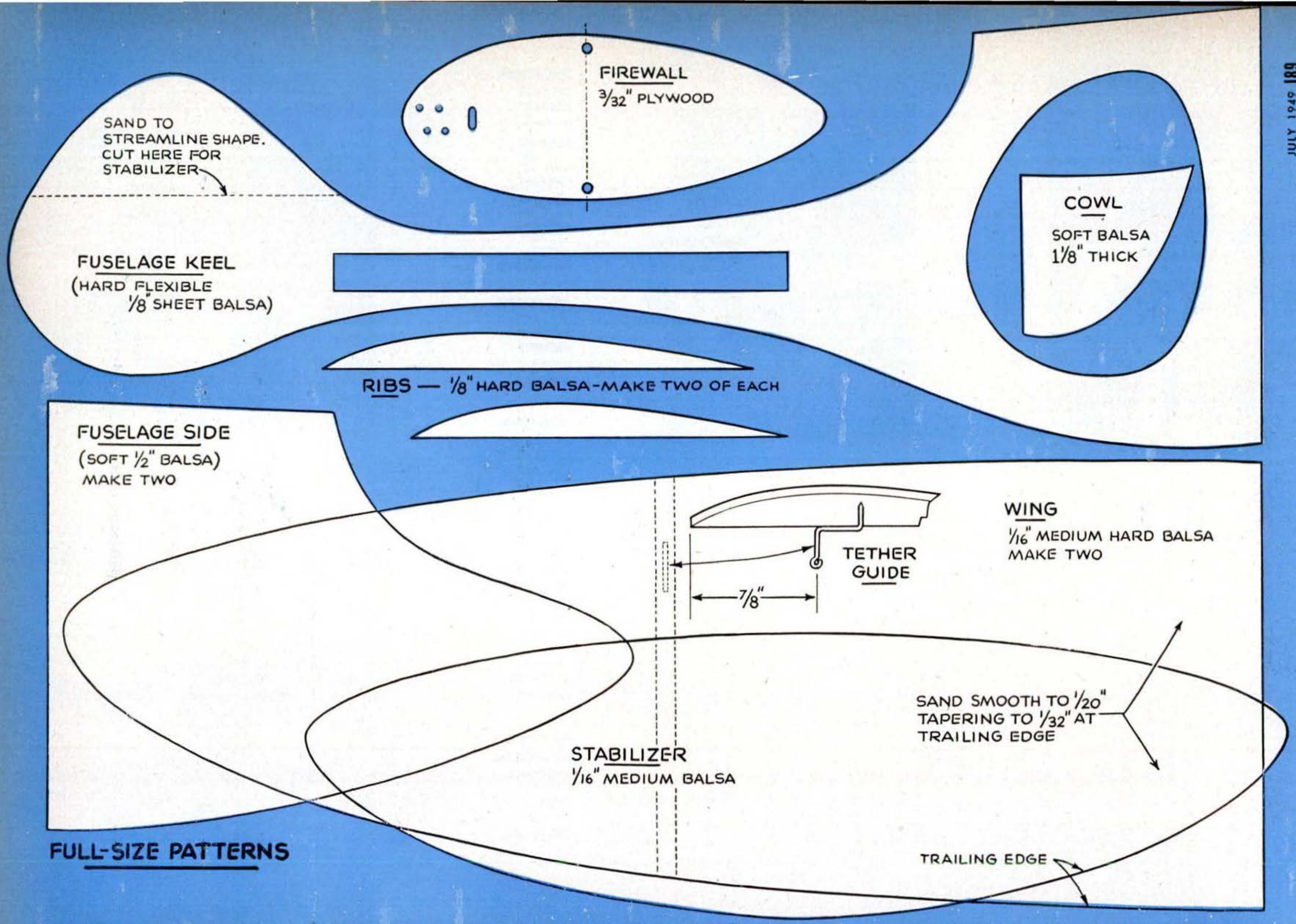
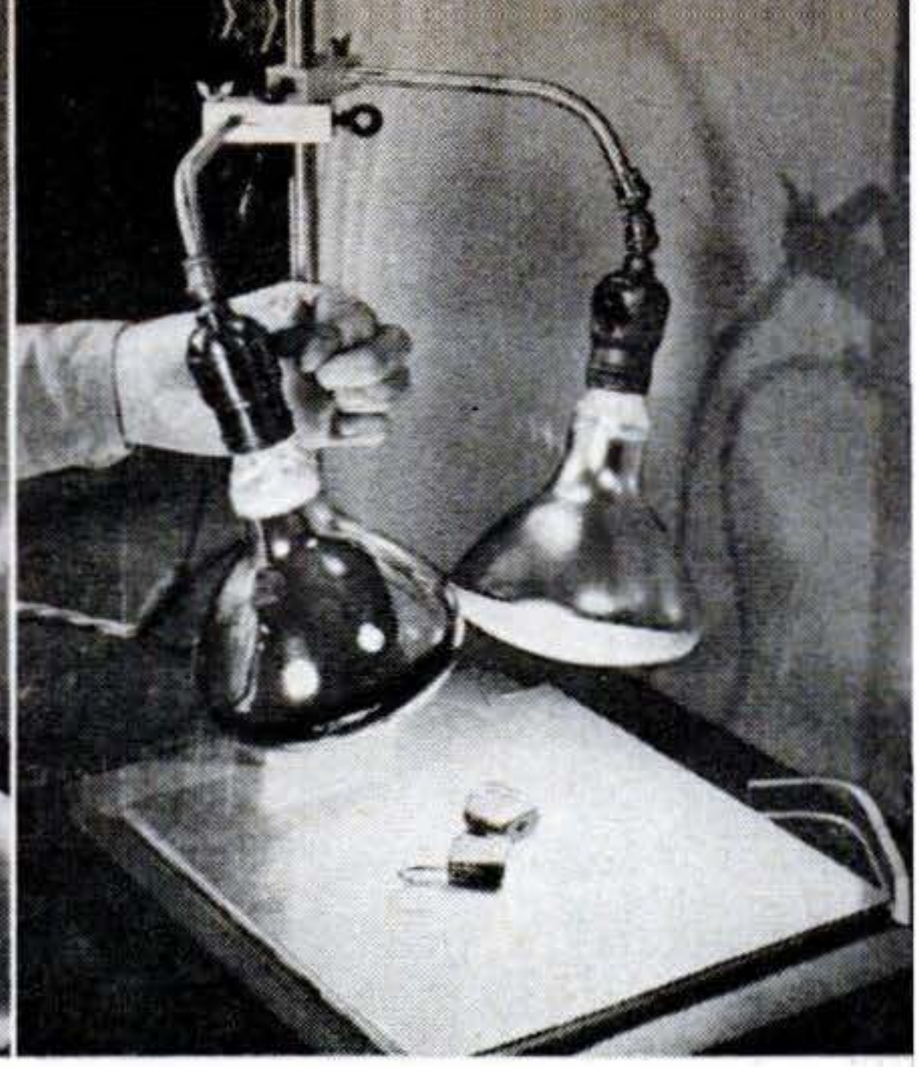
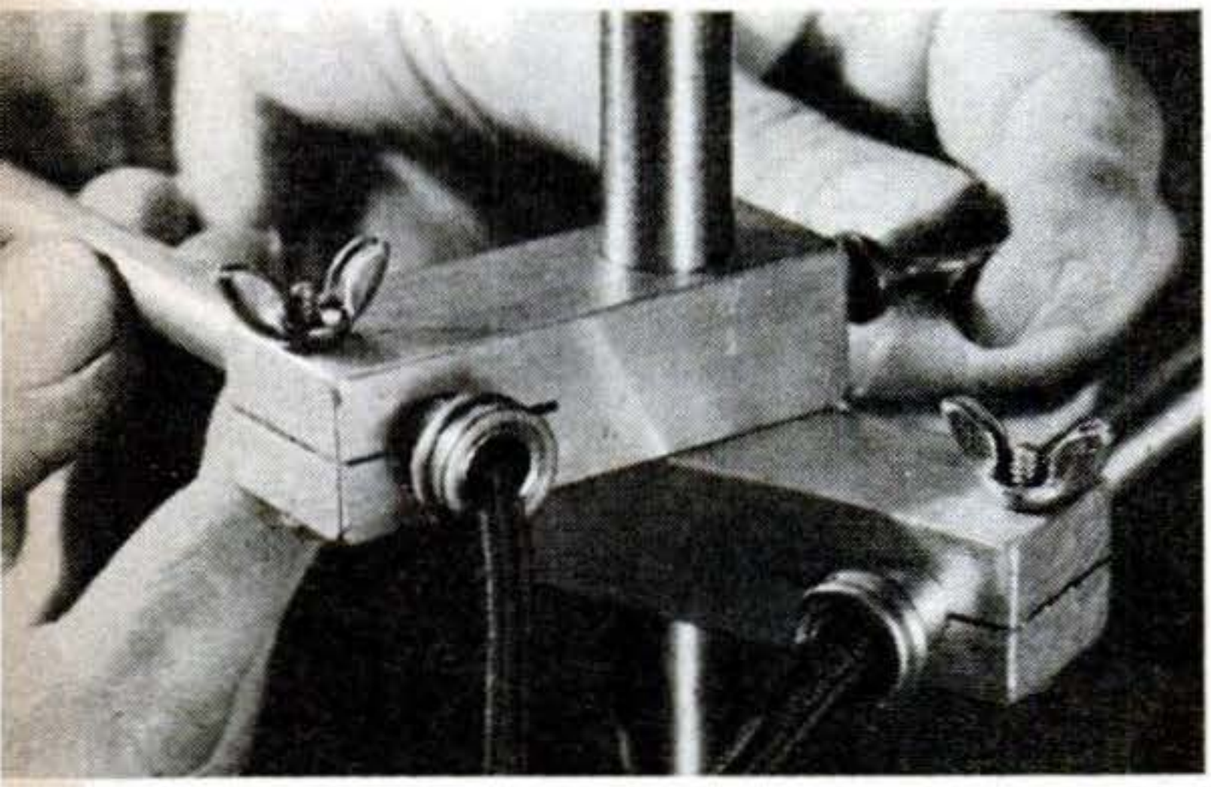


FULL-SIZE PATTERNS



Three jobs for the heating unit: warming liquid, heating plastic for bending, and drying lacquer. In 30 seconds, lacquer on the two locks was wholly dry. Lamps are two types; that heating the liquid has bulb of hard, red-orange glass and is unlikely to crack if water splashed while hot. Other type is clear, less tough. Can with ends removed forms oven for plastic.

Infrared Unit Gives Handy Heat



Detail of homemade clamps. Upper half of slotted end is drilled for clearance; lower half is threaded to keep bolt from turning.

Block that holds the upright is bolted to base. A ¼″ bolt locks upright in block. Protect base from heat with asbestos or sheet metal.

THE more you use this heating unit, the more uses it suggests for itself. The two 250-watt infrared bulbs will dry model-airplane dope, for instance, in 30 seconds and soften a piece of ¼″ plastic for bending in two minutes.

Here are some other uses I've found for the unit: heating or evaporating liquids, drying bake-on enamel, driving moisture from surfaces to be painted, drying wet wood to raise the grain, drying photo prints, removing moisture from dehydrating agents, curing vulcanizing-type rubber cement, drying other adhesives, and speeding up big soldering jobs by preheating.

To a ¾″ by 12″ by 15″ wooden base bolt a block of hardwood to hold the vertical rod or tube. This upright should be about ½″ in diameter and about 2′ long. Hold it in the drilled block with a ¼″ bolt used as a set-screw.

To protect the base from heat, cover it with an asbestos shingle. Better still, cover the shingle with polished sheet metal. It'll reflect and increase heat on the work.

Sockets for the lamps are mounted on two 9″ lengths of ⅜″ o.d. brass tubing, bent to almost 90° as shown in the photos. Although brass sockets are used here, porcelain ones would be preferable, being more heat-re-

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sistant. I fitted a ball-and-socket joint between one socket and its tube and two similar joints between the other socket and tube. These flexible fittings are handy in adjusting the lamps to odd angles, or in turning one out of the way when not in use.

Where the wires for each lamp leave the tube they are spliced to a length of well-insulated cord. To protect the insulation, ends of the tubes should be filed smooth or fitted with a protective bushing.

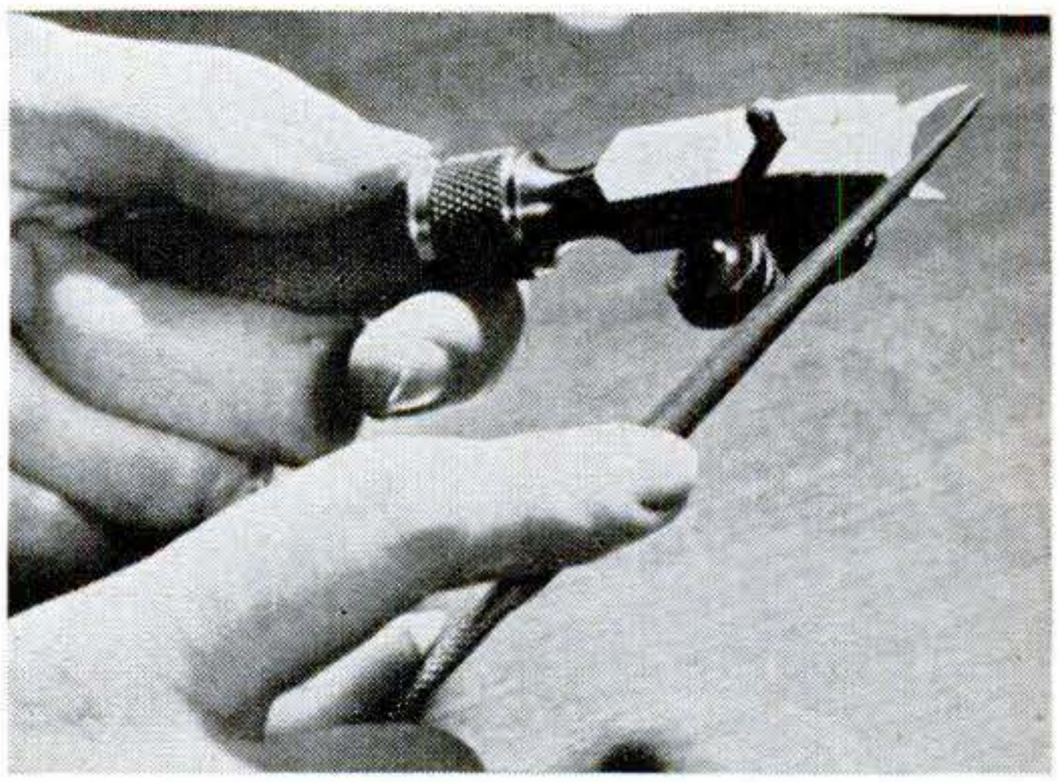
Adjustable clamps hold the socket tubes. For this part of the apparatus you can buy burette clamps from a laboratory supply house. If these are not available, you can make them, as I did, of ¾″ by ⅞″ by 2½″ aluminum blocks. The lower half of the slotted end is threaded for the bolt. The upper half is drilled clearance size. This arrangement keeps the bolt from turning when the wing nut is tightened. The ¼″-20 wing bolt in the other end of the block acts as a setscrew to hold the clamp at any point on the upright. I made these wing bolts by soldering washers in the slots of ¼″-20 machine bolts.—*Walter E. Burton, Akron, O.*

Little Vises Are Big Help

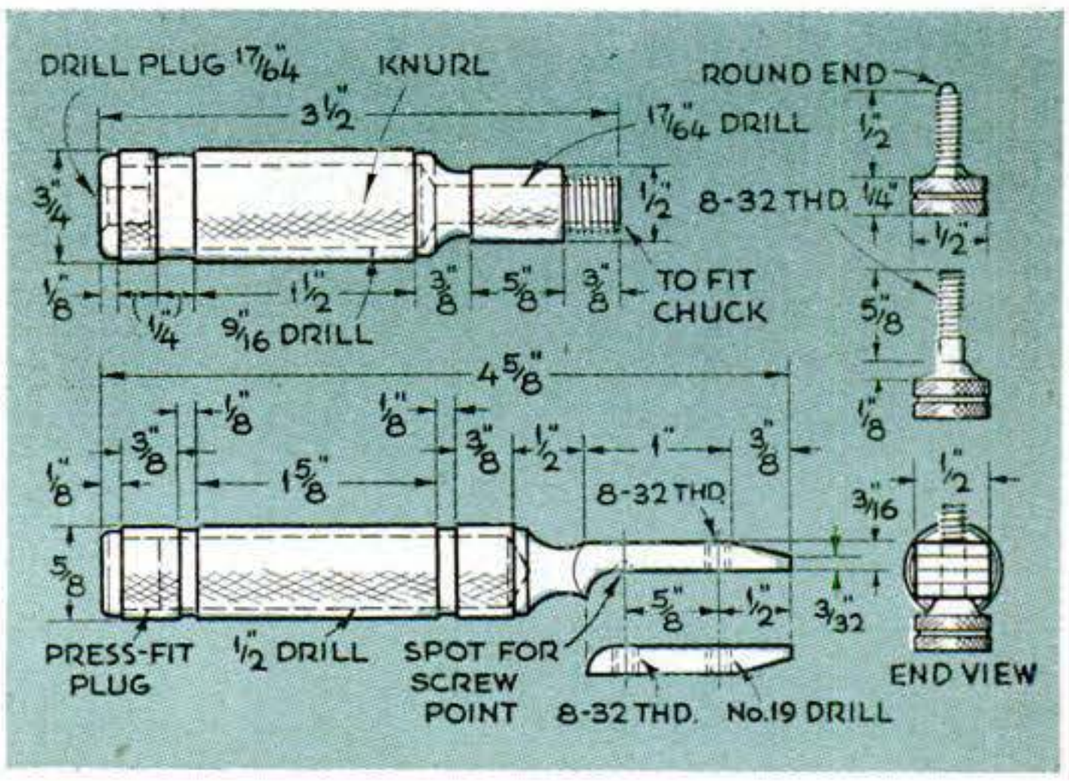
MODELMAKERS, machinists, and others working with small parts will find these hand vises more useful than ordinary pin vises, thanks to their much greater capacity and holding power. The one using a ⅛″ or ¼″ chuck will replace several pin vises.

Turn the handle from cold-rolled steel, drill through 17/64″, and run in a 9/16″ drill for 2″. This not only lightens it but lets you hold long rods (up to 17/64″ diameter) in the tool. You can leave the handle end open or, if you want a fancy job, turn a press-fit plug.

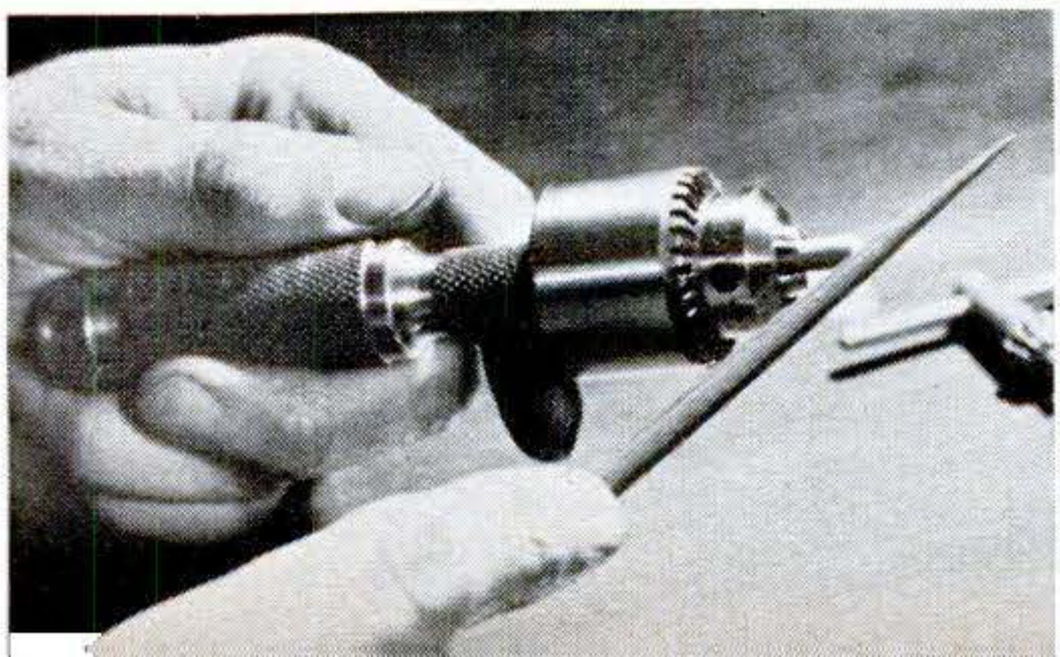
The other vise—shown in use in the top photo—holds flat or square stock. Turn the handle from drill rod or tool steel. Shape the stationary jaw from the round stock with a hacksaw and files. You'll probably find it necessary to form the small, movable jaw from a separate piece of stock. Fit it carefully by filing; the security of the grip depends on a close fit between the jaws. Clamp the jaws together and drill and tap for the clamp screws. Note that the single hole in the stationary jaw is threaded and the opposite hole in the lower jaw is drilled for clearance. Heat-treat the jaws and clamp screws. In use, the work is clamped in the vise by the long screw and then locked by the other.—*W. A. Conway, Macedonia, O.*



This little vise holds small flat work securely in the double-screw clamp. One screw adjusts the jaw to size; the other clamps it.



Here's a good use for an old chuck, if you've got one. With it you can hold screws for slotting or handle other slippery round objects.



Handle is a lathe job. Its big knurled shank gives you a good grasp on it. Jaws are hacksawed and filed or milled to size.

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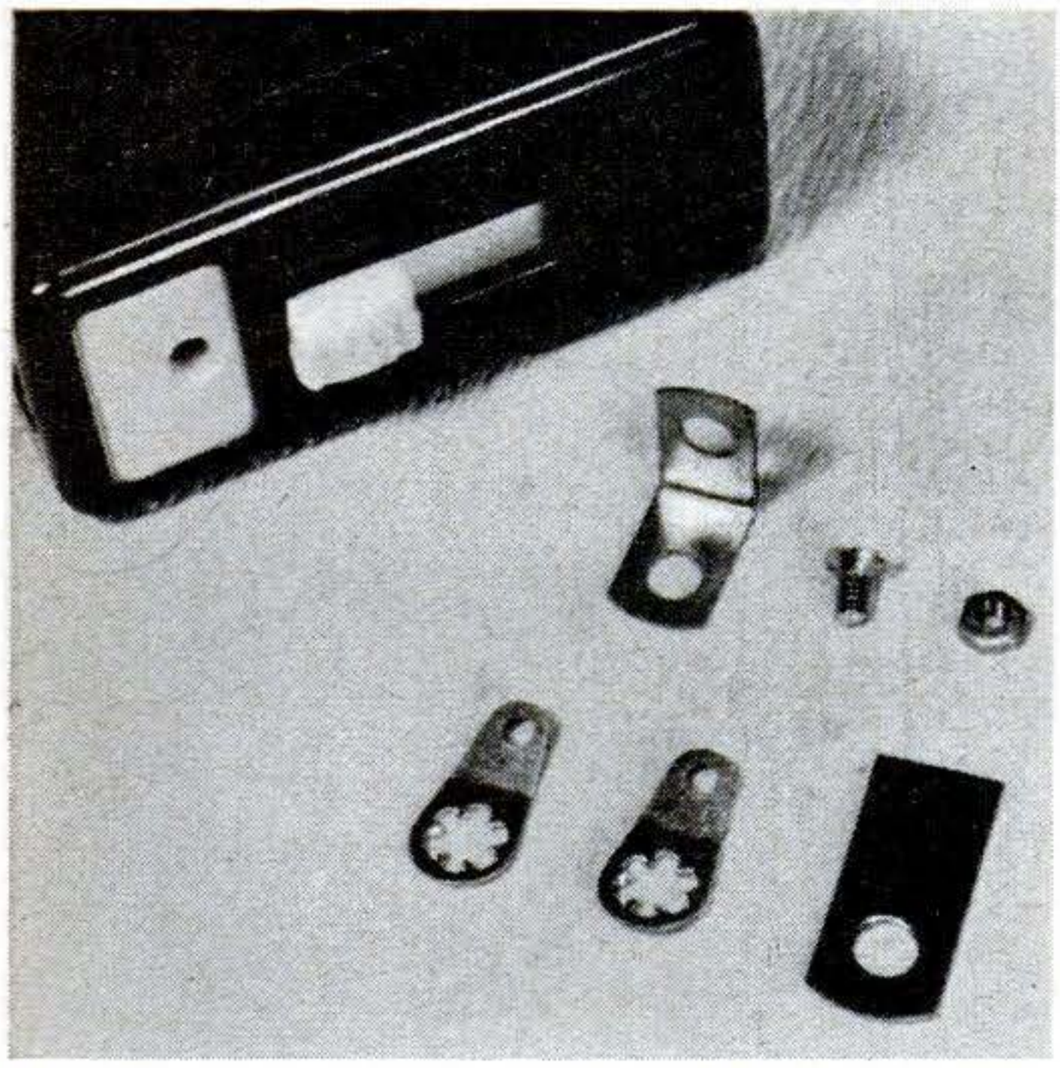
RF Booster Stretches Radio's Range

Plugging in an extra stage of amplification can improve the performance of small portables.



Making a switch out of the slide top of a cigarette case calls for a ½" angle bracket, a flat mending plate, soldering lugs, and hardware.

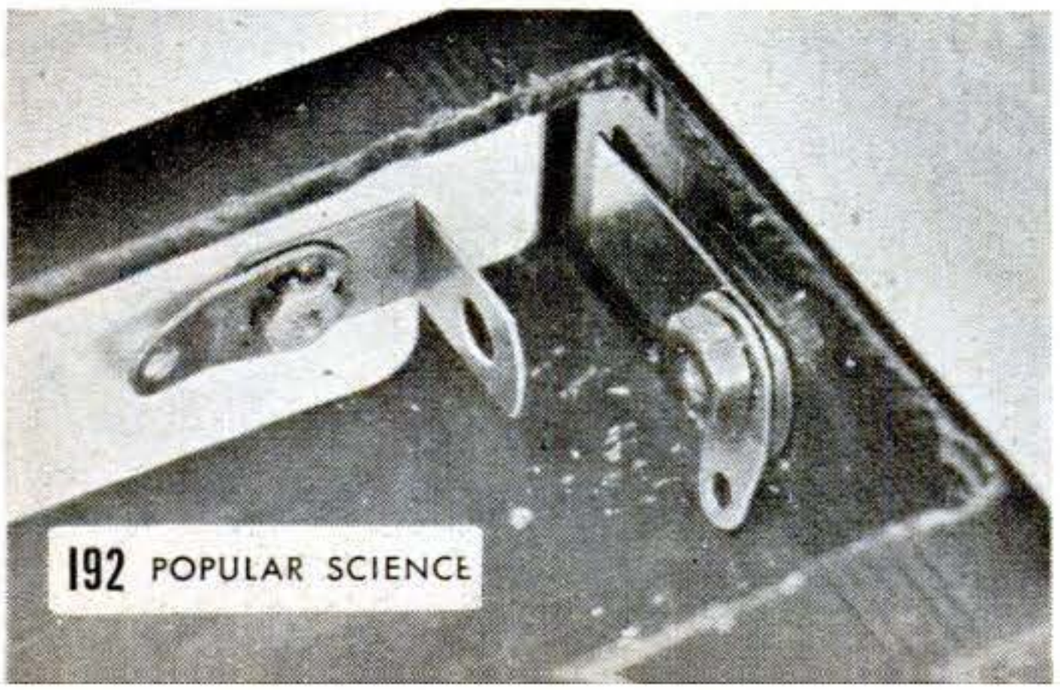
By Albert Rowley

I LIKE my portable radios small. It makes sense to me to have a little set that I can lug around without effort, rather than one that threatens to pull my arm off at the shoulder.

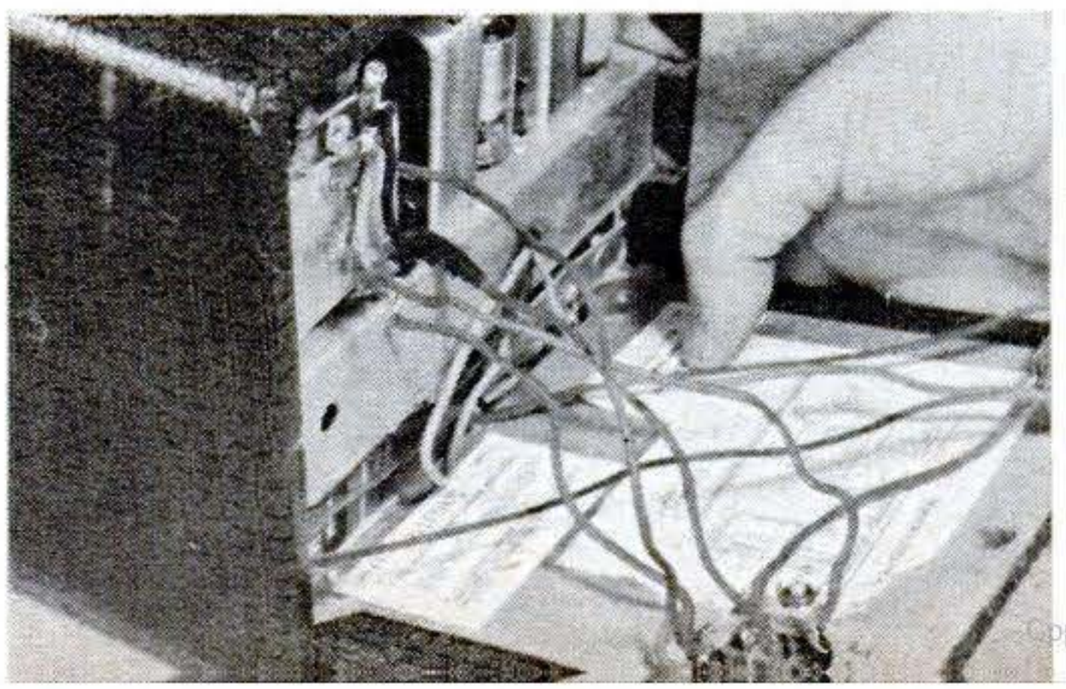
At the same time I know my compact portable doesn't have as much pick-up power built into it as one of the larger, more expensive sets. It works fine close to a small station and up to 50 miles from a high-powered transmitter; but when I take it on a long ride, performance definitely falls off.

To overcome this defect, I built an RF booster for my set. It consists of an untuned RF stage packed in a plastic cigarette case. It can be plugged into the portable when and if it's needed. The booster increases the signal pickup of the portable, converting its four-tube circuit into a five-tuber on

Assembly of the switch can be seen here. The view is through a 1½" by 2" rectangular cut-out made in the side of the cigarette case.



A 5-prong wafer socket mounted in the back of the cabinet supplies both electrical contact and mechanical support for the booster.



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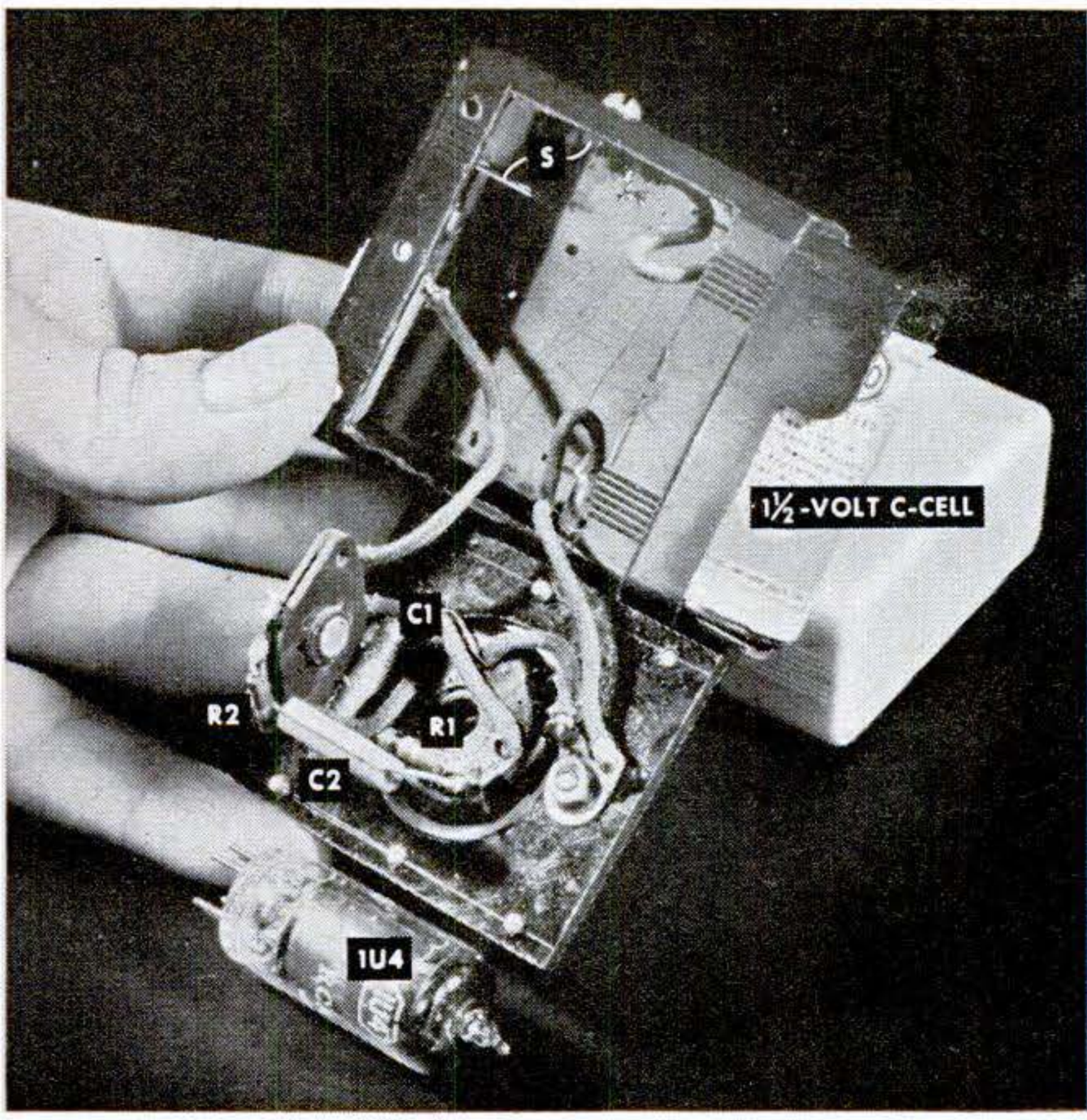
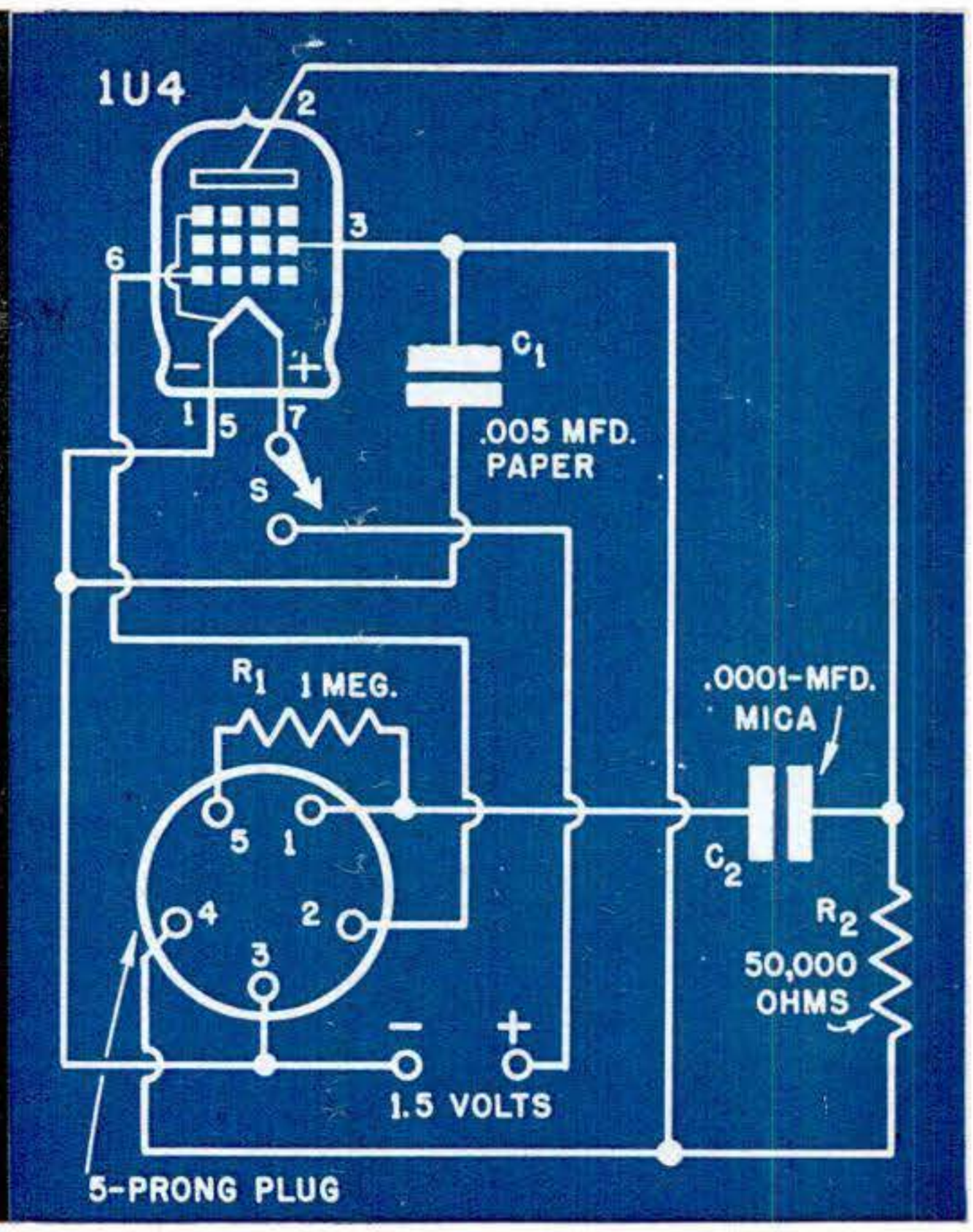


Layout and wiring of the parts is simple. The thing to watch for is clearance of the tube and socket in the 2"-wide opening in the case.



The small parts used can be soldered directly to the 5-prong mounting plug and the 7-pin miniature wafer socket that holds the tube.

demand. With it the set can reach out reliably for hard-to-get stations.

A booster like this will improve a great many portables, but there are many more on which it would be wasted. Sets that already have a stage of RF amplification or two stages of IF won't benefit by the addition. To find out how yours stacks up, remove the back cover and take a peek inside. A 3-gang tuning condenser is a sure indication that you *don't* need this booster. Less certain but a good clue is the number of tubes. Five or more—not counting the rectifier, if any—mean the set already has enough RF or IF gain. As a final check, look at the tube-type numbers. More than one of any of the following tubes indicates that you don't need a booster: 1T4, 1U4, 1N5-GT, or 1LN5.

If examination shows that your set can benefit from some additional radio-frequency amplification, your first step should be to purchase the little "cabinet." I used a plastic cigarette case with a slide opening on top through which the smokes can be popped out. The slide is useful because it's a cinch to convert it into an on-off switch.

In the side of the case near the top, cut out a rectangular opening. Make a cover for the opening from a piece of plastic about 2" by 2¼". It can be fastened to the case by drilling undersize holes and using small machine screws that will tap their own threads.

Drill and file a hole in the center of the plastic rectangle for a 5-prong plug that has a metal ring for flush mounting. Two machine screws and nuts secure it to the plastic panel. Inside and at right angles to the plastic attach a 7-pin miniature wafer socket by soldering its pin 5 to one of the machine screws. Make a strong mechanical bond to hold the miniature socket rigidly. A couple of resistors and condensers as well as leads for the switch and the A battery are then soldered in to complete the wiring.

The filament supply comes from a size C flashlight cell that fits nicely in the width of the case; connections can be made by clips or bars bolted to the inside of the case. B-plus voltage is tapped off the set.

To make connections to the set, I drilled a hole in the back of the radio cabinet and mounted a 5-prong wafer socket. Connections to this socket are made as follows:

Prong 1 goes to the grid of the converter tube. This is found at the fixed-plate terminal of the antenna tuning condenser (the larger plates of a two-gang tuning unit). The original connection is unsoldered. If

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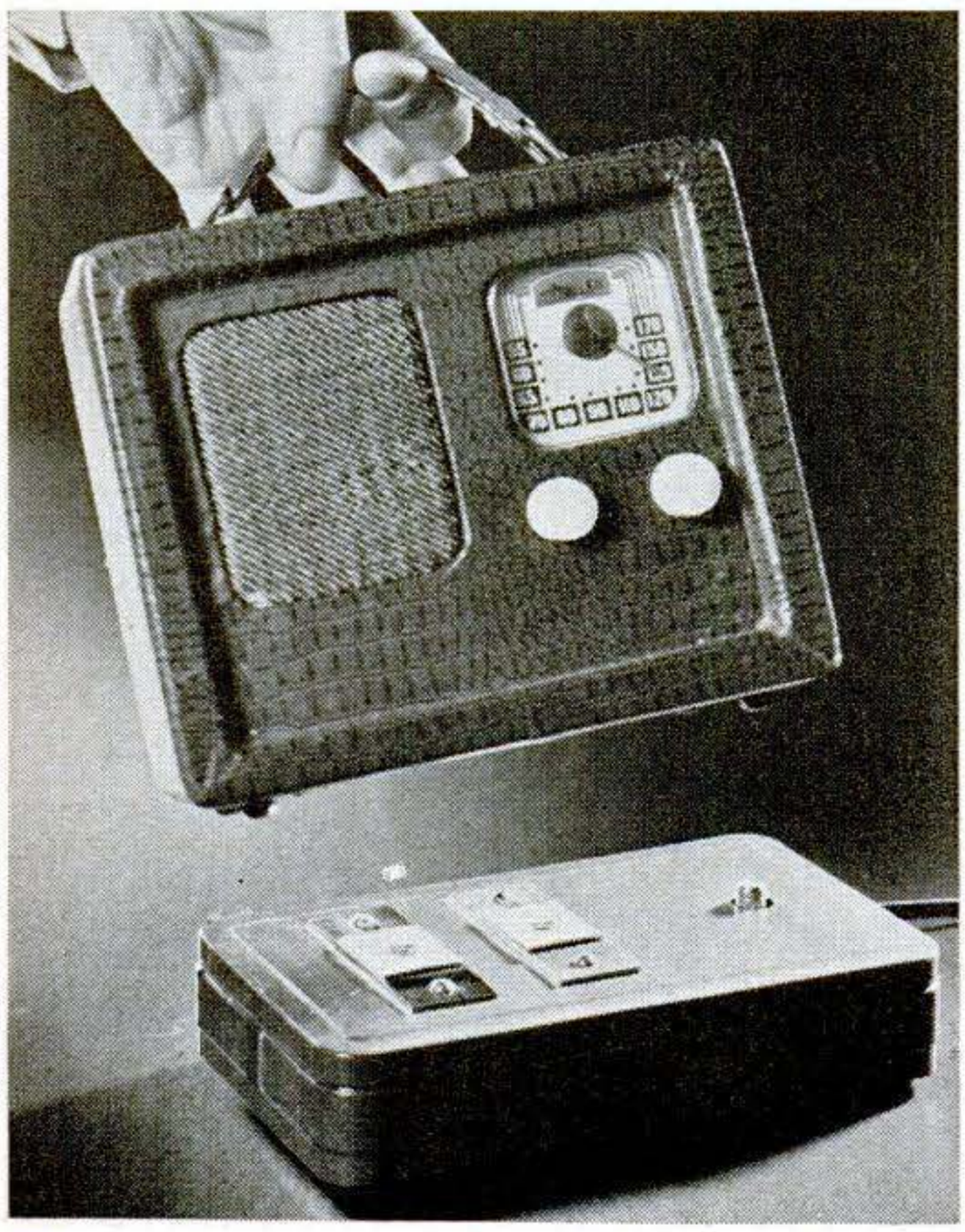
there are two connections at this point, don't touch the one that goes to the loop antenna. Prong 2 goes to the wire you have just unsoldered from the tuning condenser. Prong 3 runs to the chassis of the set. Prong 4 leads to the positive terminal of the B battery. If you have a 3-way portable, it may go either here or to a B-plus point inside the set. Prong 5 can go either to the chassis of the set or to the AVC line (the black lead from either of the IF transformers). Try both of these connections and solder it permanently to the one that gives best results.

For those times when the booster isn't going to be used, buy an extra 5-prong plug and solder a jumper lead between prongs 1 and 2. Plugging in the jumper in place of the booster restores the original circuit. END

B Supply Cuts Battery Cost

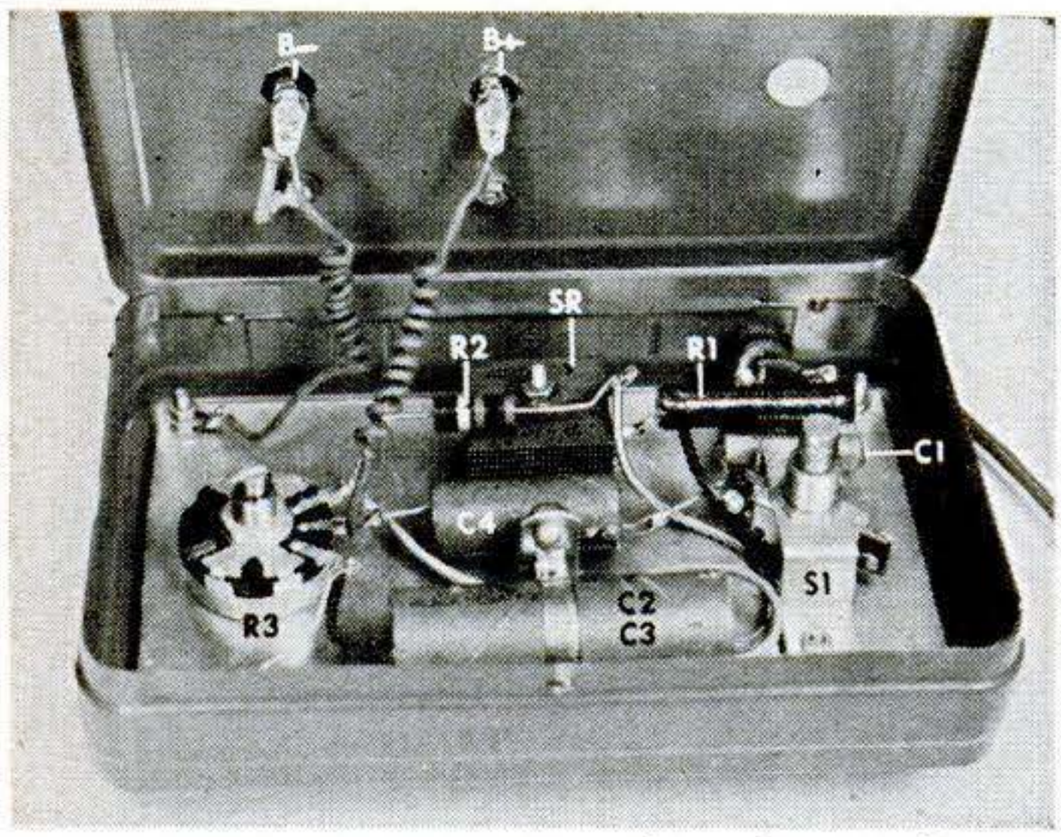


Listen all you want without draining those expensive batteries. The little box supplies B voltage; weight of the portable turns it on.

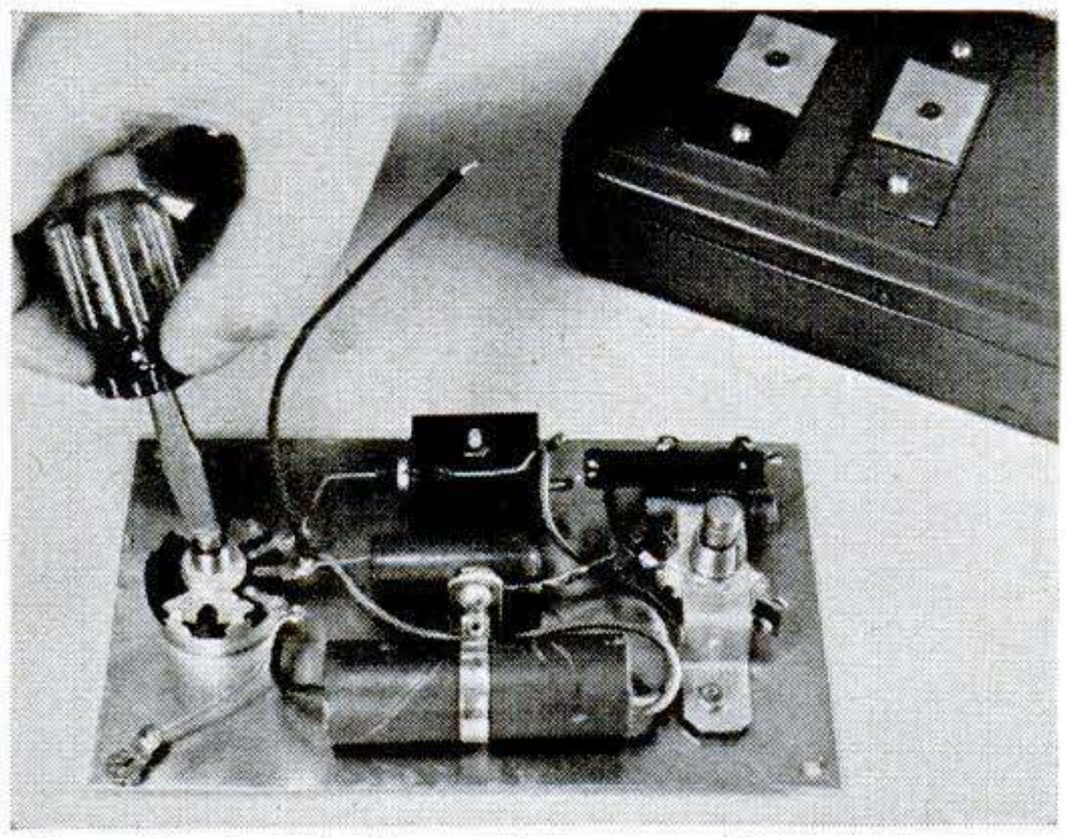
HAVING discovered how easy it is to make my small portable behave like a bigger set, I decided to get rid of another sore spot in its operation—the high cost of B batteries. It's no fun to shell out a couple of bucks every few weeks to replace the weakened battery. For very little more than the price of a replacement battery I built this perpetual B supply that works off any 115-volt AC or DC line. I still use flashlight cells for the A supply, but their cost is insignificant.

Like the RF booster described above, this device is independent of the set and doesn't impair its usefulness as a portable. While my set uses a 67½-volt battery, the same eliminator will serve other sets requiring up to 90 volts. It would be useless, naturally, on 3-way portables.

Instant warm-up is retained by using a 100-ma. selenium rectifier. This and all other parts are assembled inside a steel first-aid box measuring 1½" by 4½" by 7½". You'll find a cabinet of about this size convenient, since it forms a platform on which to rest the set.



Parts are mounted on a flat chassis that is fastened inside the steel box by machine screws slipped through the rubber feet.



The shaft of the voltage-regulating potentiometer is sawed off to fit inside the box. Slot the shaft to permit screwdriver adjustment.

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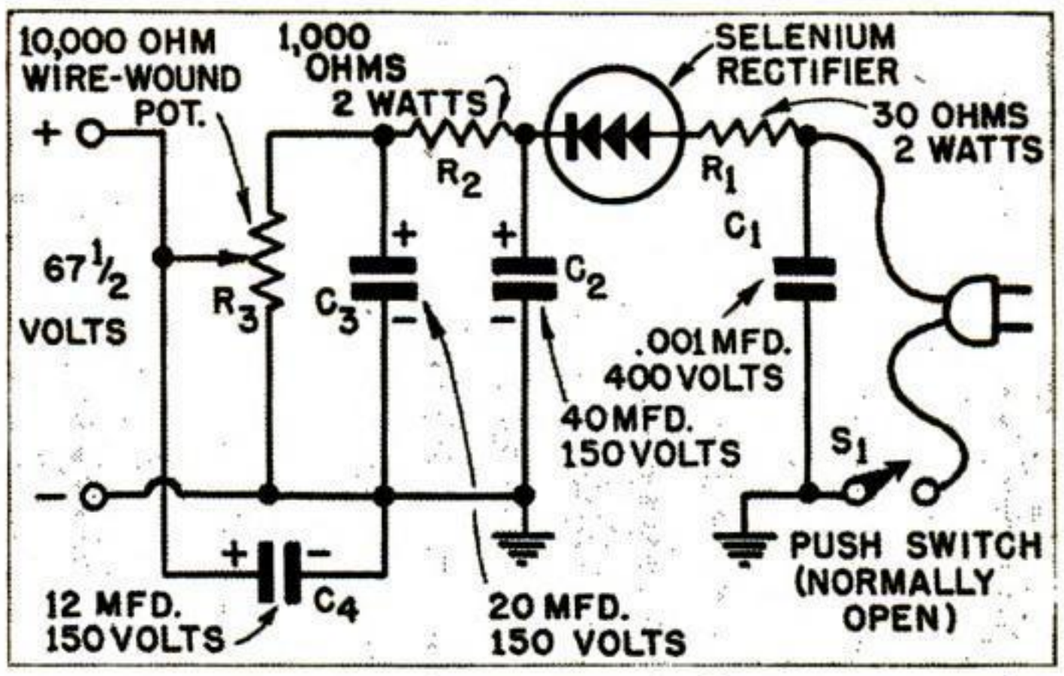
On top of the box and insulated from it by pieces of fiber are two 1″ by 1¼″ aluminum contact plates. The remaining parts are mounted on a flat chassis inside that is secured by four mounting screws through the bottom. Use rubber insulating feet on the bottom and never set the box on a grounded metal surface like a radiator or sink. Better still, use a plastic chassis panel to insulate all components from the box, wiring together the grounded points in the diagram, and put in a two-pole switch instead of a single-pole one. This will open both sides of the power line. You could still get a shock by pushing the switch and touching the terminal plates, or one plate and an outside ground, so keep the gadget away from kids.

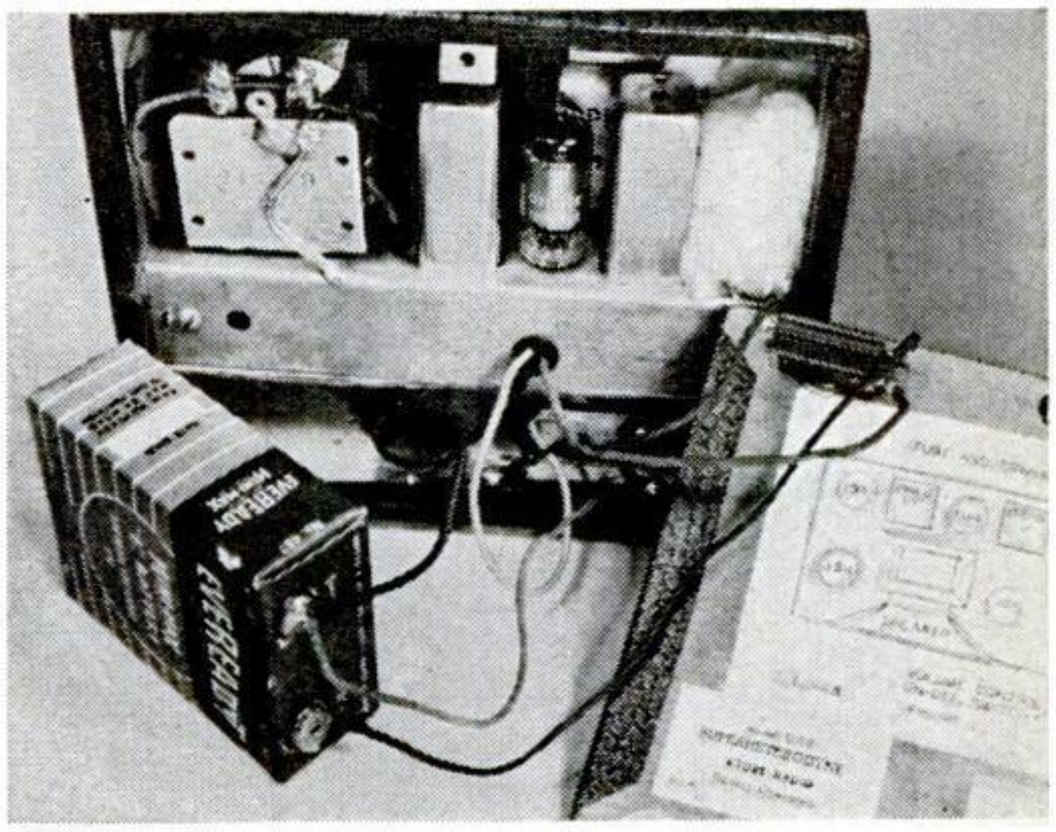
One side of the line cord is connected to the negative terminal of the selenium rectifier through a 30-ohm wire-wound resistor. The other side goes to the chassis through a push-type switch (S1). An aluminum strap holds this switch upright, permitting the plunger to project through a hole in the top of the cabinet. The switch is of the normally-off type. It is turned on by the weight of the radio and goes off automatically when the set is lifted off. It's a good idea to remove the set when you are through listening, for current will continue to flow through R3 even with the set turned off.

Voltage output is regulated by a wire-wound potentiometer rated at 2 watts or more and having a resistance of 10,000 ohms. You can adjust this to any value from about 60 to 100 volts. Set it 10 to 15 percent above the nominal rating of the battery used in your portable. The higher voltage will make the set more sensitive than it usually is on batteries alone, and it won't do any harm to the circuit components.

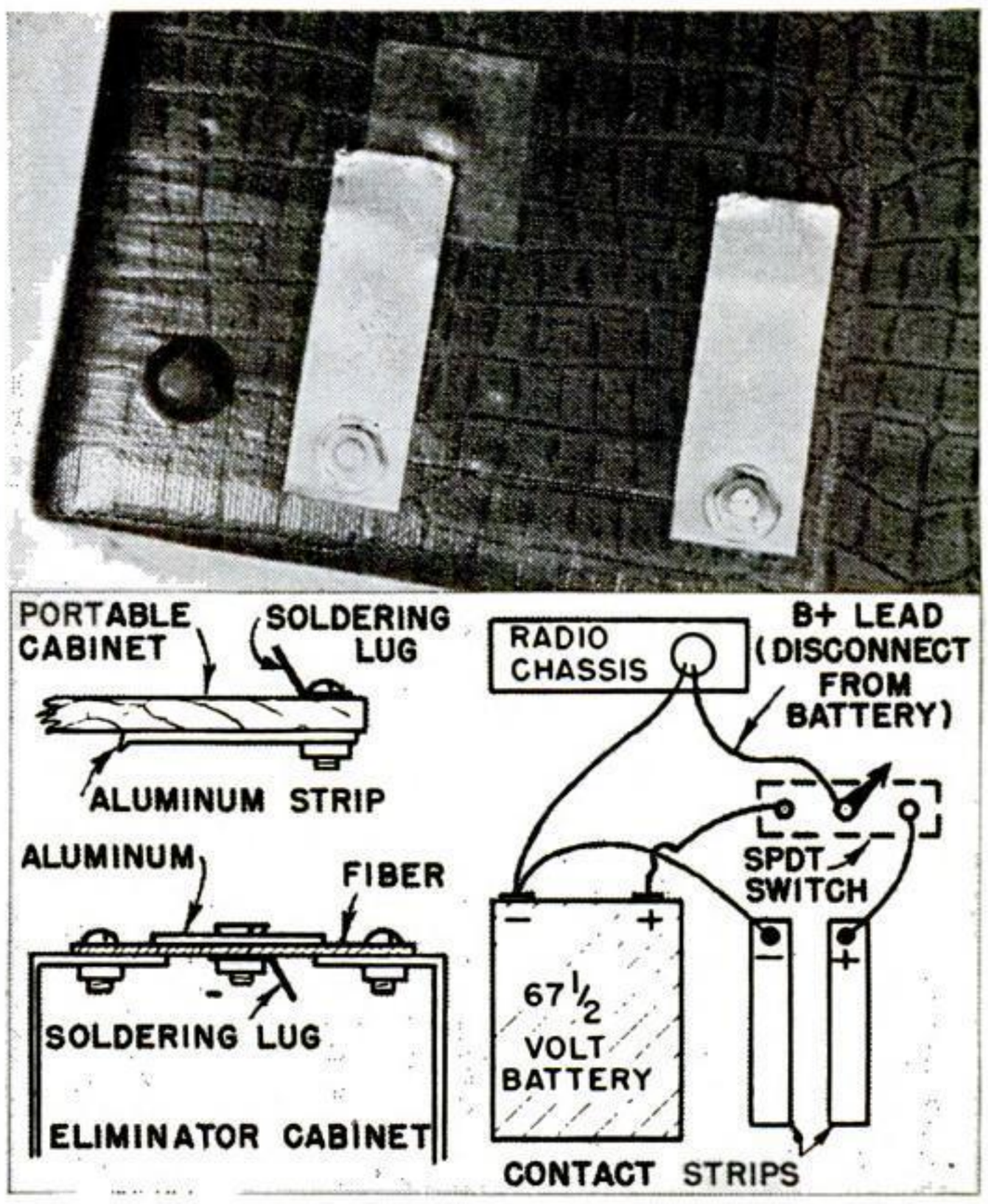
You'll have to make a few minor changes in the receiver. The first is to make some arrangement for disconnecting the battery when the eliminator is used. To do this, simply cut the lead to the plus terminal of the B battery and connect it to the center arm of a SPDT toggle switch. Wire one side of the switch to the battery and the remaining switch terminal to an aluminum contact on the bottom of the cabinet. The circuit and suggested method of attachment are shown at the lower right. Make sure that the contacts on the set line up with those on the eliminator. The switch can be placed in the back panel of the radio.—*Albert Rowley, Manhattan, N. Y.*



Wiring shown is for a metal chassis. To make the unit still safer, use a plastic panel, a DPDT switch, and connect all grounds together.



Connections to the portable are made directly to the battery terminals. The B-plus line is cut and rewired through a toggle switch.



Contact strips are added to the bottom of the radio. These must line up with the contacts on the eliminator. The outer one is negative.

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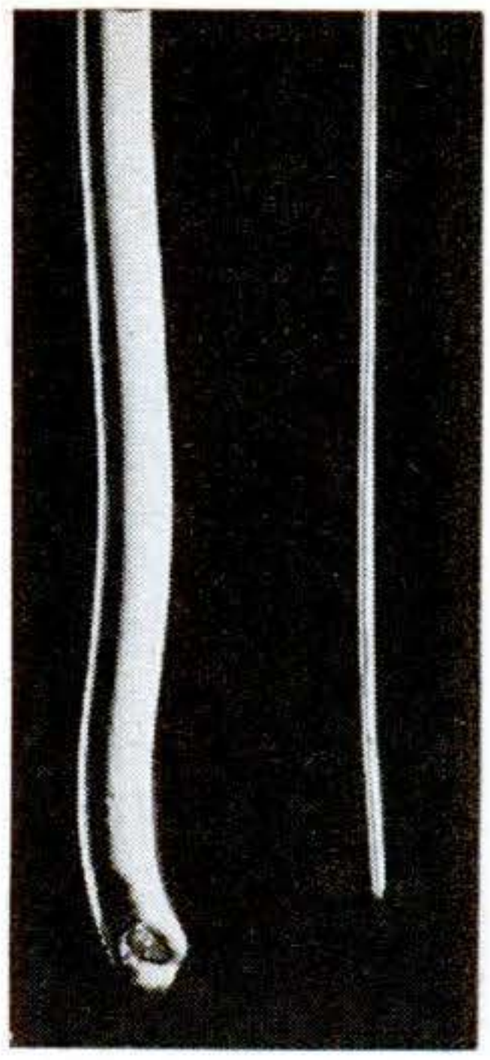
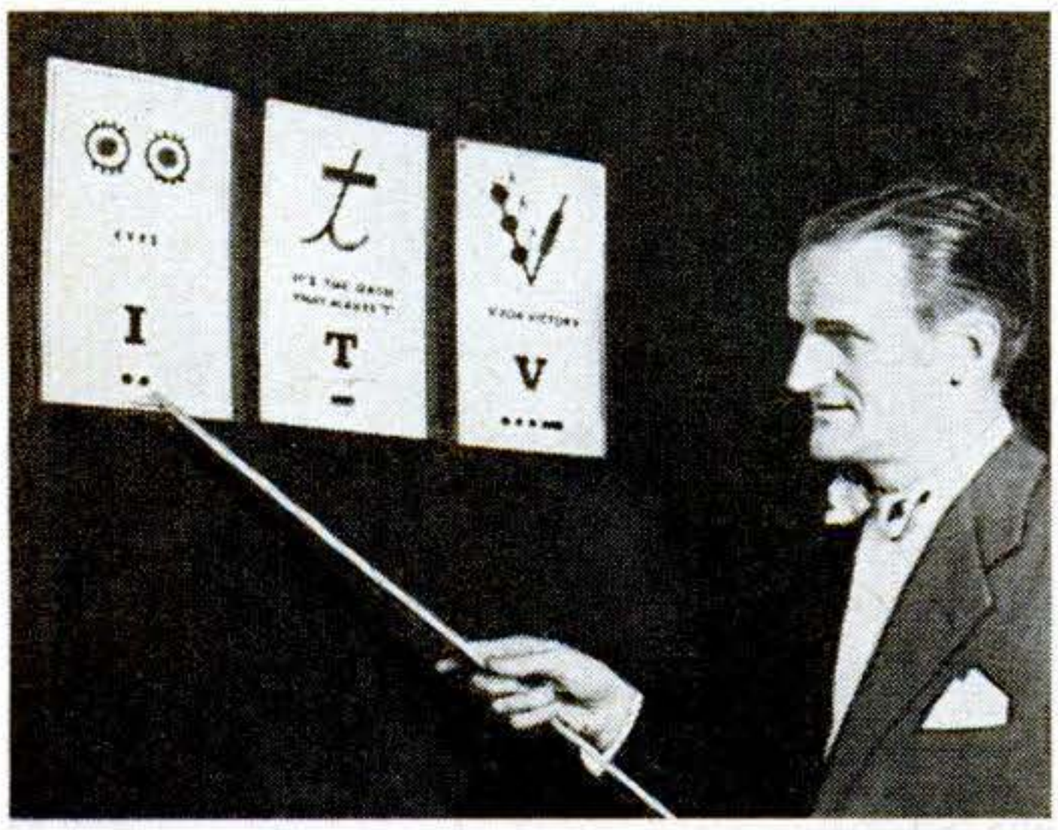
NEWS IN ELECTRONICS

Adapter Plays 7″ Disks. A turntable and pickup announced by Zenith adapts their Cobra® record changers for use as manually operated players with 33⅓ or 45 r.p.m. 7″ disks. The adapter fits over the record spindle of the 78-r.p.m. changer and takes its power from it. Connection to the audio system is made by removing the cartridge from the larger arm and inserting an adapter plug. The player sells for about $9.

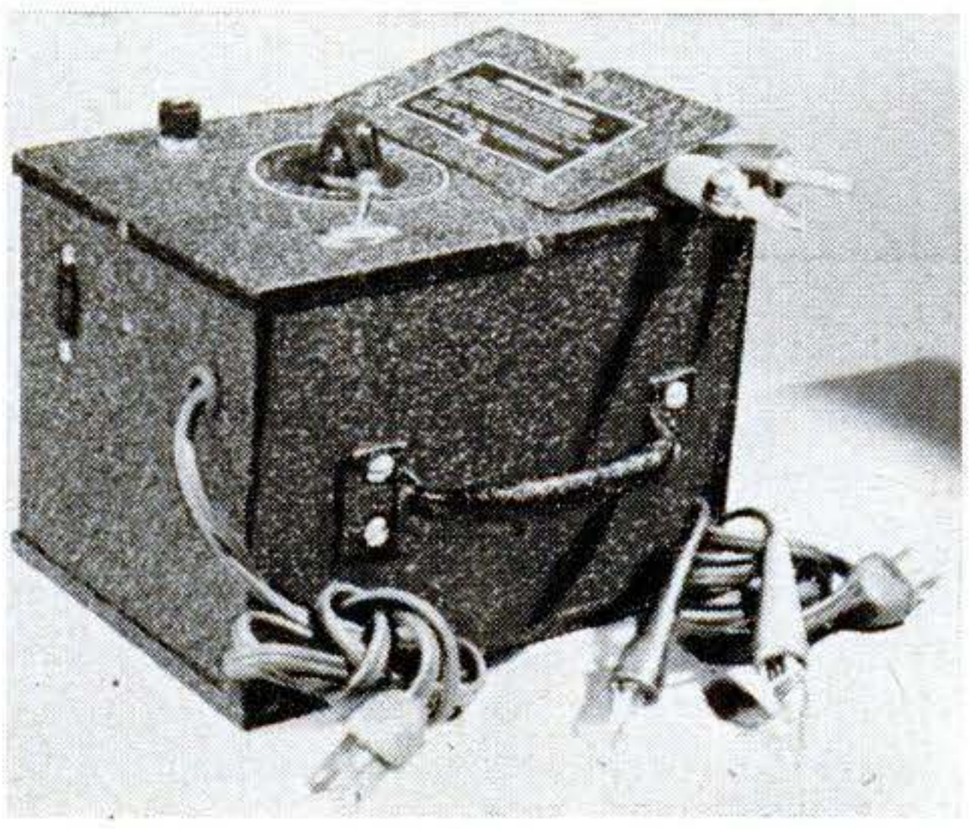
Thin Solder. One of the smallest cored solders ever made is shown at the far right alongside a length of solder of the conventional size. Both pieces are shown greater than actual size; the smaller one measures only .011″ in diameter. Kester Solder Company, Chicago, produces the tiny solder. The noncorrosive flux core is of the resin type, said to be nonconductive.



Fluid Prevents Disk Static. An anti-static compound sold by Merix Chemical Co., Chicago, is said to eliminate dust attraction and static noises on the surfaces of Vinylite® records. Vinyl plastic is used for many conventional records as well as all narrow-groove platters. A static charge on the record surface usually appears as a crackling sound. The compound can also be used on other plastic, metal, or fabric surfaces that are subject to static charges or static-caused dust accumulation.



Pictures Aid Memory. Learning the dots and dashes of the Morse code may become a little easier through a visual-association method developed by Otto H. Luther, New Preston, Conn. Pictures, key words, and color are used to help a learner associate the structure or sound of a letter with the proper arrangement of dots and dashes. The picture above shows the method used in identifying some of the letters.



Box Prescribes Proper Filter. Quick and positive tests for interference-producing appliances can be made with this filter box offered by Aerovox Corporation, New Bedford, Mass. The unit contains a number of filters and allows for various methods of connection to the suspected appliance. A selector switch and clip-on leads permit comparisons to determine the best kind of filter and connection.

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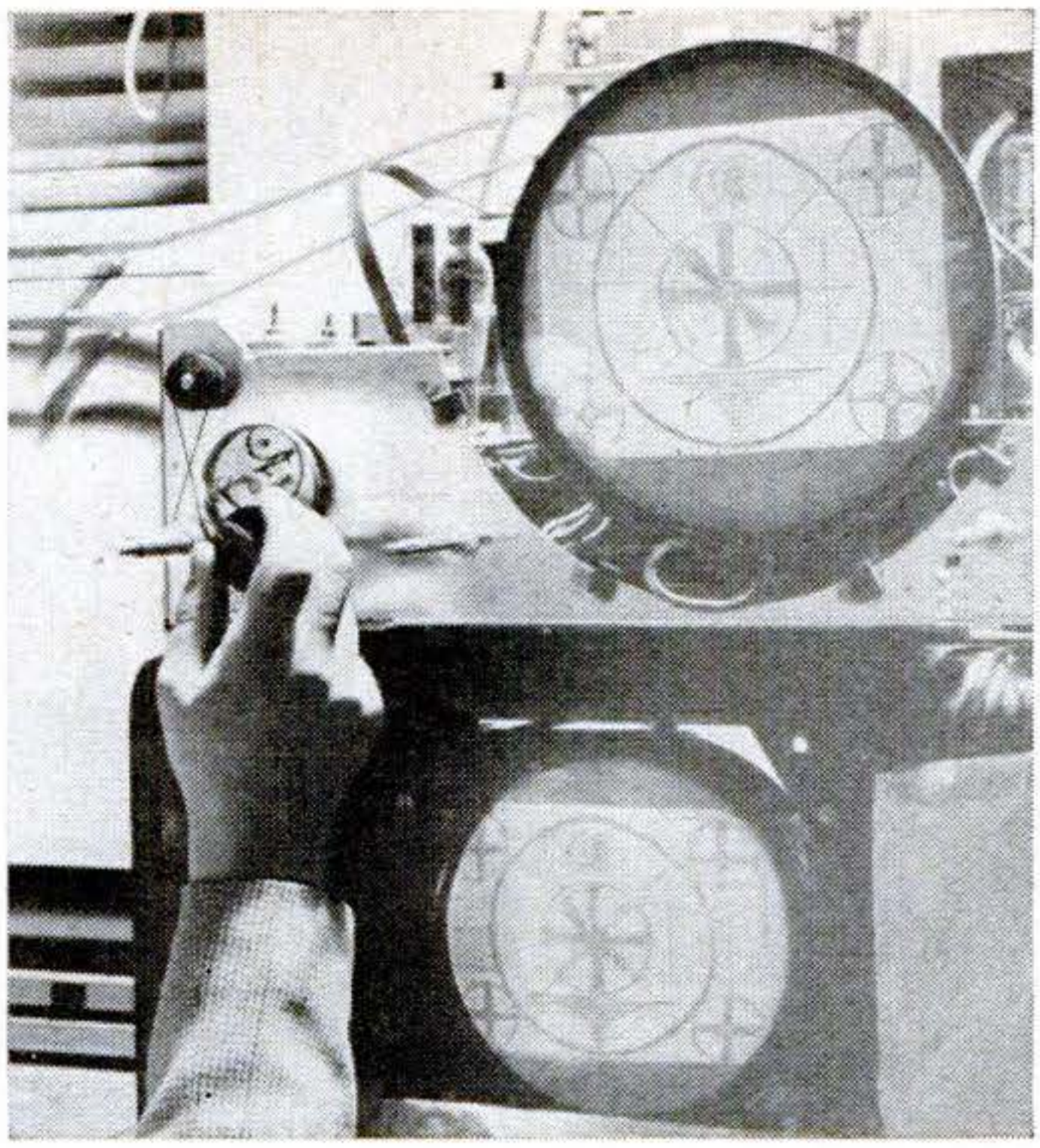
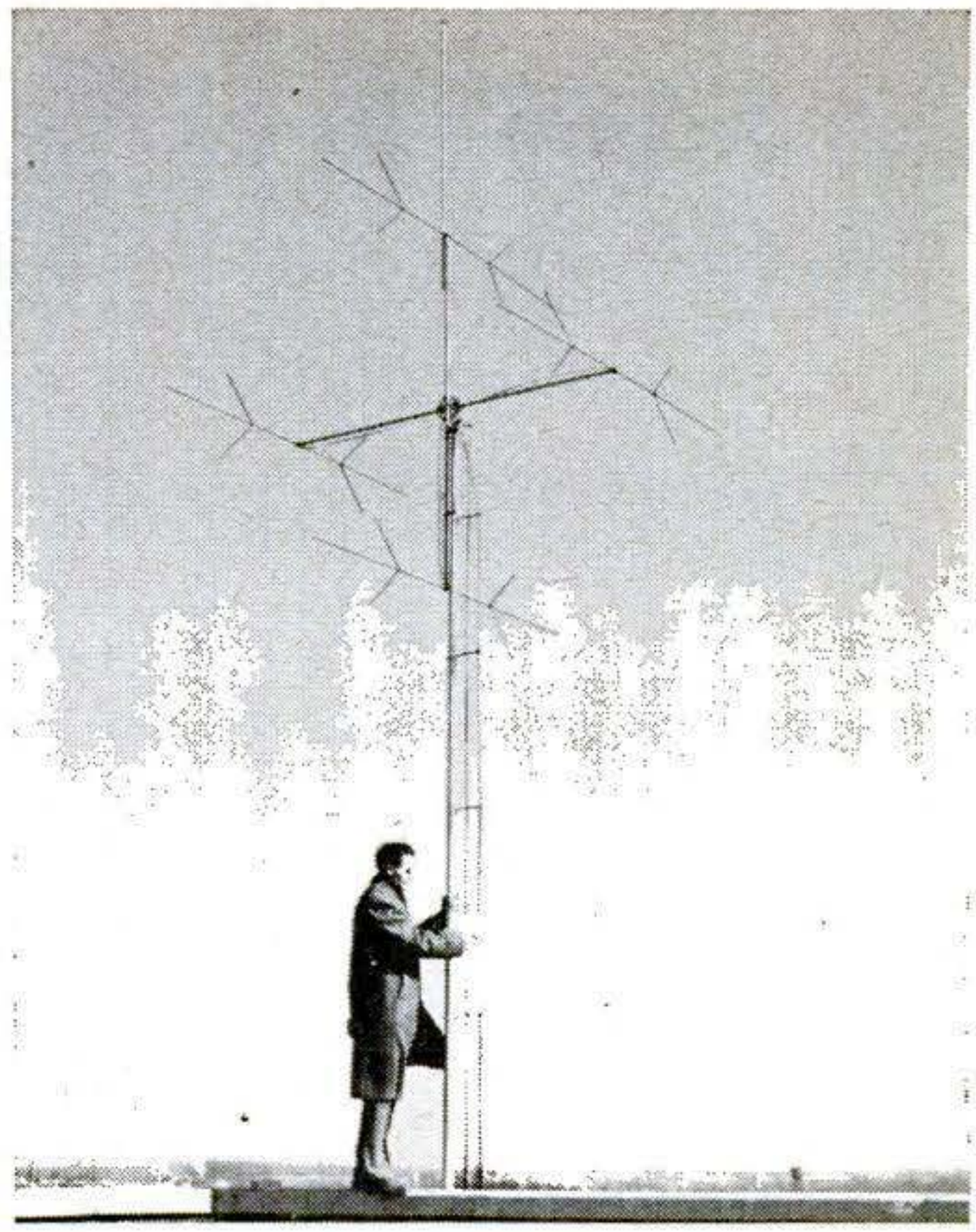


Small Sets Get Larger Tube

SPLITTING the difference between the present 7″ and 10″ picture tubes, General Electric has come up with a new metal-shell, glass-face tube having a diameter of 8½″. Said to cost no more to make than the smaller tube, it offers 50 percent more picture area, or 39 square inches as against the previous 26. It is expected to find wide application in forthcoming low-priced receivers. In the photo above the new 8½″ tube is shown on top of a standard 7″ one.

Mirror Aids Rear Adjustments

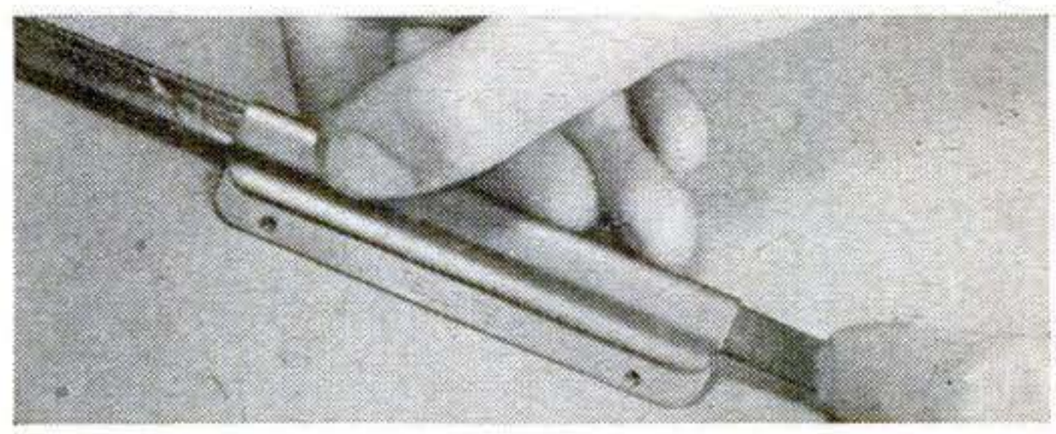
FOR the convenience of servicemen who have to watch the face of a TV picture tube while setting the controls at the back of the chassis, the Federal Engineering Co., New York, offers a metal mirror and collapsible stand. Its price is $6.



TV Antenna Is Directional

A NEW one-way antenna may enable television set owners who live in fringe areas between stations to eliminate interference resulting from competing signals. Even when a station is too far away to be received clearly (say 100 miles), its signal may be strong enough to spoil reception from a nearer station on the same channel.

The array shown above, built by RCA, will receive broadcasts from one direction while effectively rejecting those coming from the opposite direction. It can be made to favor either direction and is reversed by a switch placed near the receiver.



Clip "Loads" 300-Ohm Lead-in

MISMATCHING between a television antenna and receiver can often be minimized by the use of a 4″ metal clip slipped over the flat 300-ohm line as shown. The clip is moved along until best results are obtained. Telcite Television Corp., East Islip, N. Y., makes this one. A similar item is produced by Crystal Devices Co., Freeport, N. Y.

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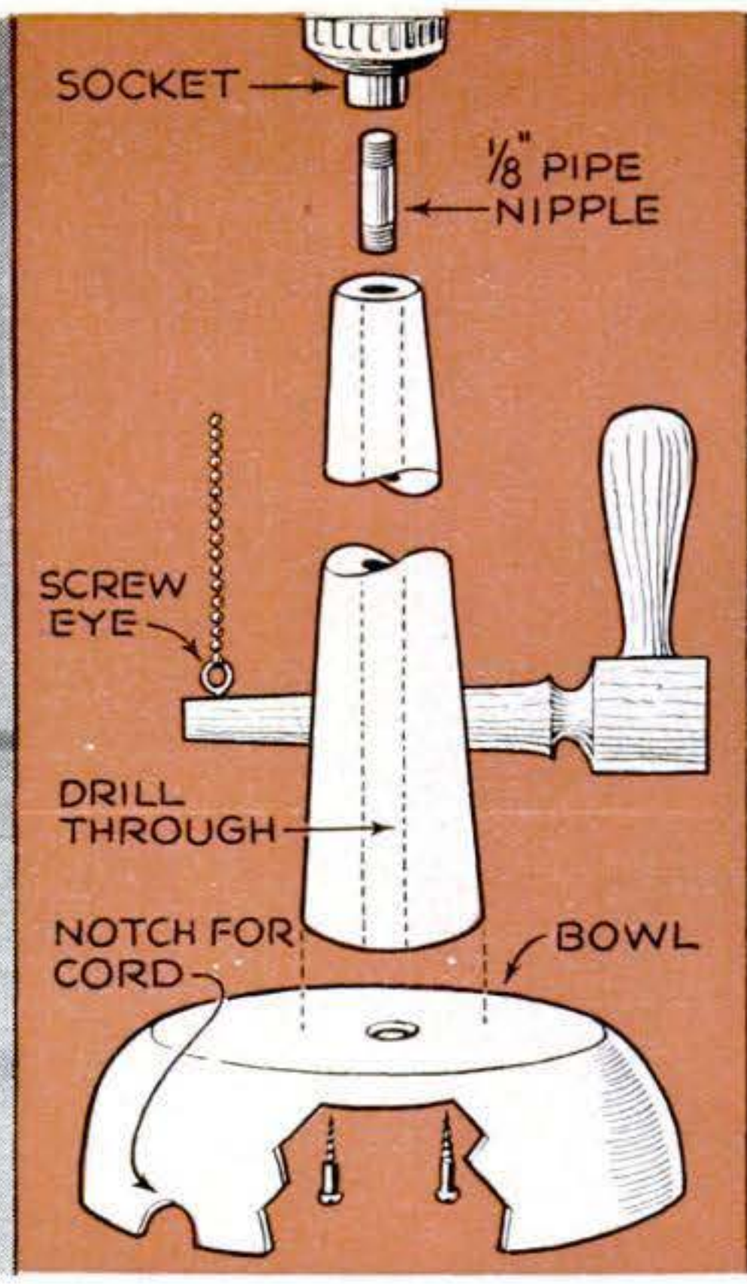
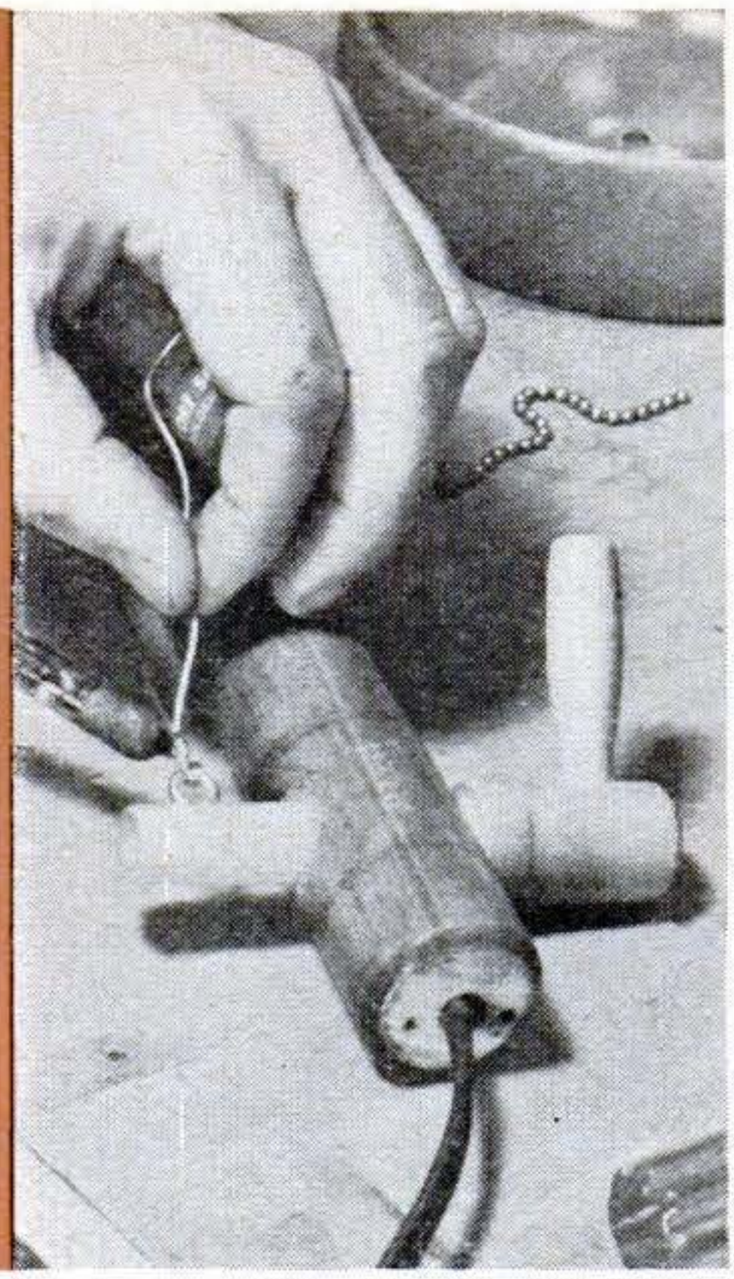




Completed lamp (left) is turned on and off by twist of spigot's handle. Picture wire soldered to screw eye (right) connects to socket chain. Extra piece of chain can be substituted for wire. Drawing shows details of lamp assembly. Only two screws hold spigot to salad-bowl base.

Spigot Turns the Light On

ROLL out the barrel, but save the spigot. It forms the standard of this novel lamp, and the tap is hooked up to pull the socket chain.

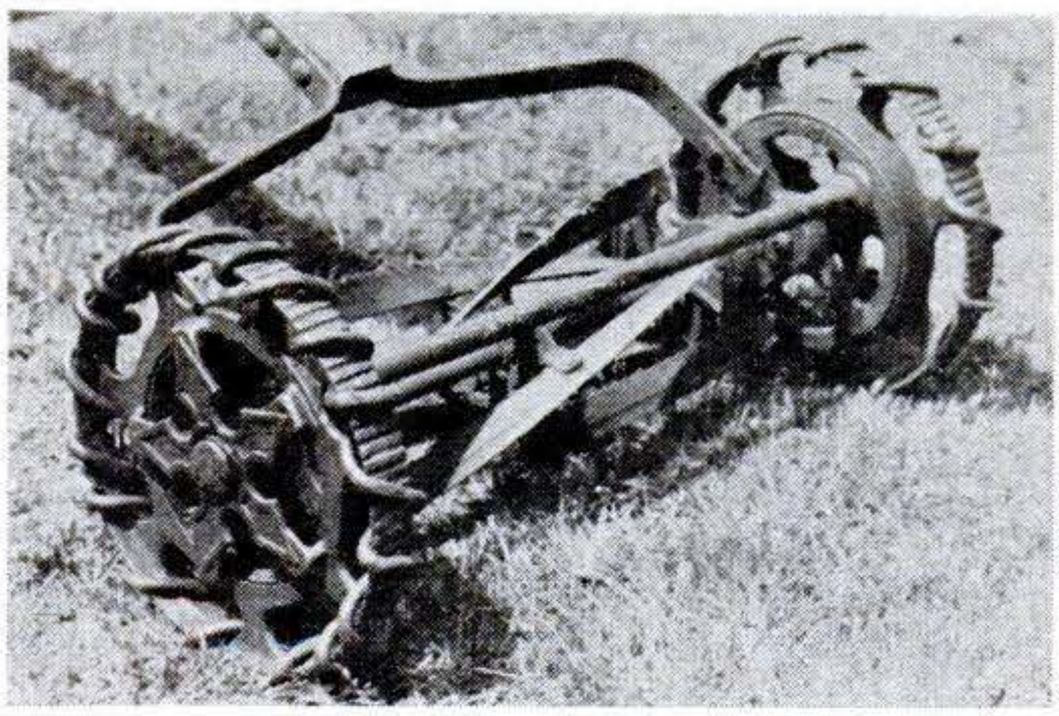
The base is a wooden salad bowl from a dime store. Spigots of this kind can be bought from mail-order houses, at many country stores, or just liberated from a barrel. In addition, you'll need wire, a socket, a ⅛" pipe nipple, and a couple of small wood screws. The spigot is already drilled for most of its length. Drill it out from the big end to the tap. Also enlarge the valve hole so that it will turn enough to switch the lamp on and off without hitting the wire.

Drill a hole in the center of the bowl, with two smaller holes on each side of it. These are for the wood screws that'll hold the spigot to the bowl. Before assembling the lamp, notch the bowl rim for the cord. Force the pipe nipple into the small end of the spigot and you're ready to wire the lamp. Anchor the cord inside the curved portion of the bowl with a staple.

Last step is to attach a piece of picture wire to the socket chain, and solder it to the screw eye in the spindle. I used a clip-on shade.—*Arthur Miller, Manhattan, N. Y.*

Cable Gives Lawn Mower Nonskid Wheels

WHEEL slippage during heavy cuts or on wet grass was reduced after I wrapped the wheels of my lawn mower with rubber-covered electrical cable. Plastic clothes-line also works very nicely, or even ordinary cotton sash cord. These, however, have a shorter life than the cable. Whichever material you select, simply loop it tightly around the wheels, as shown in the photo, and lash the ends securely together with a piece of twisted wire. All protruding ends are clipped off.—*John Stofan, Teaneck, N. J.*



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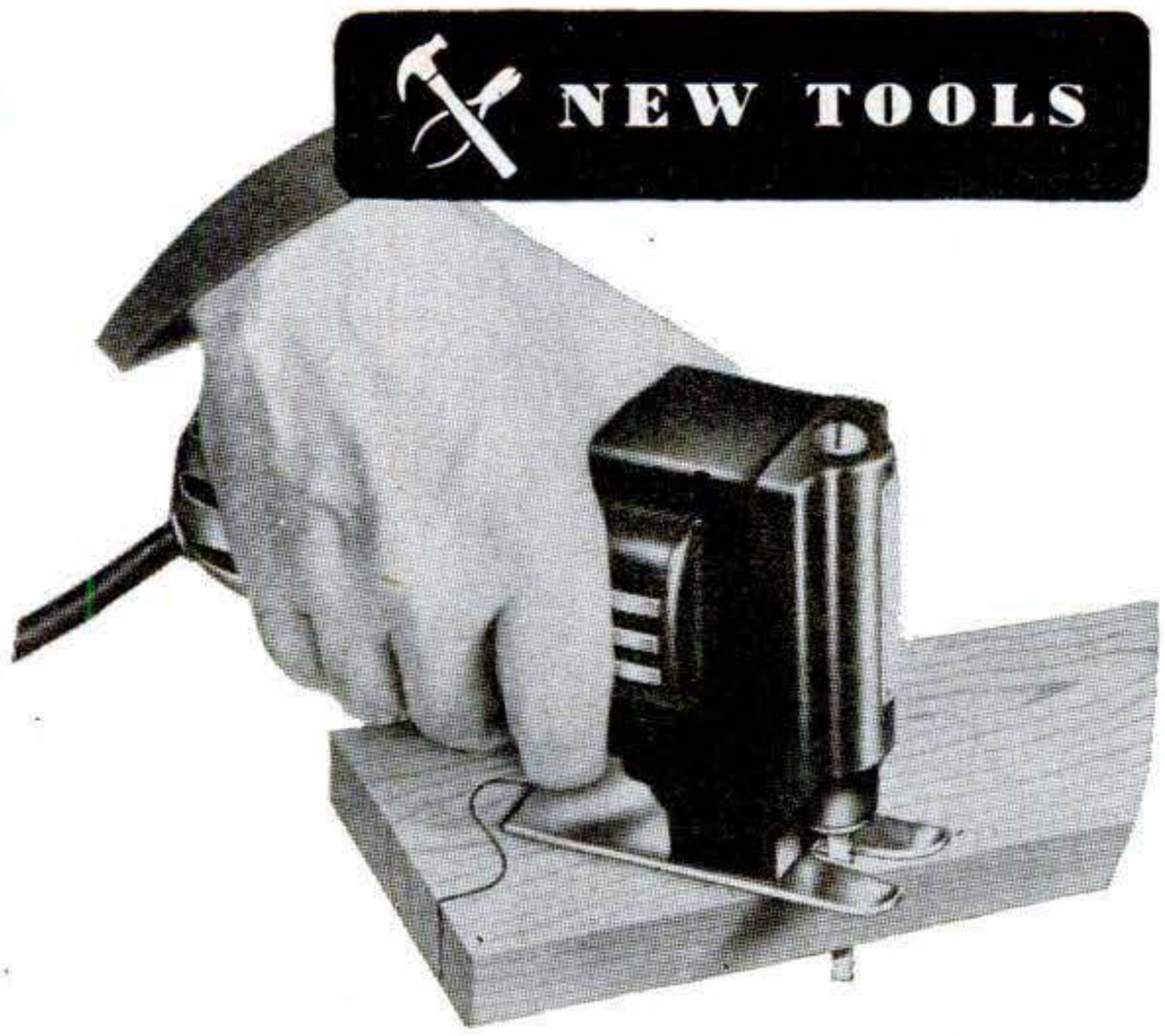
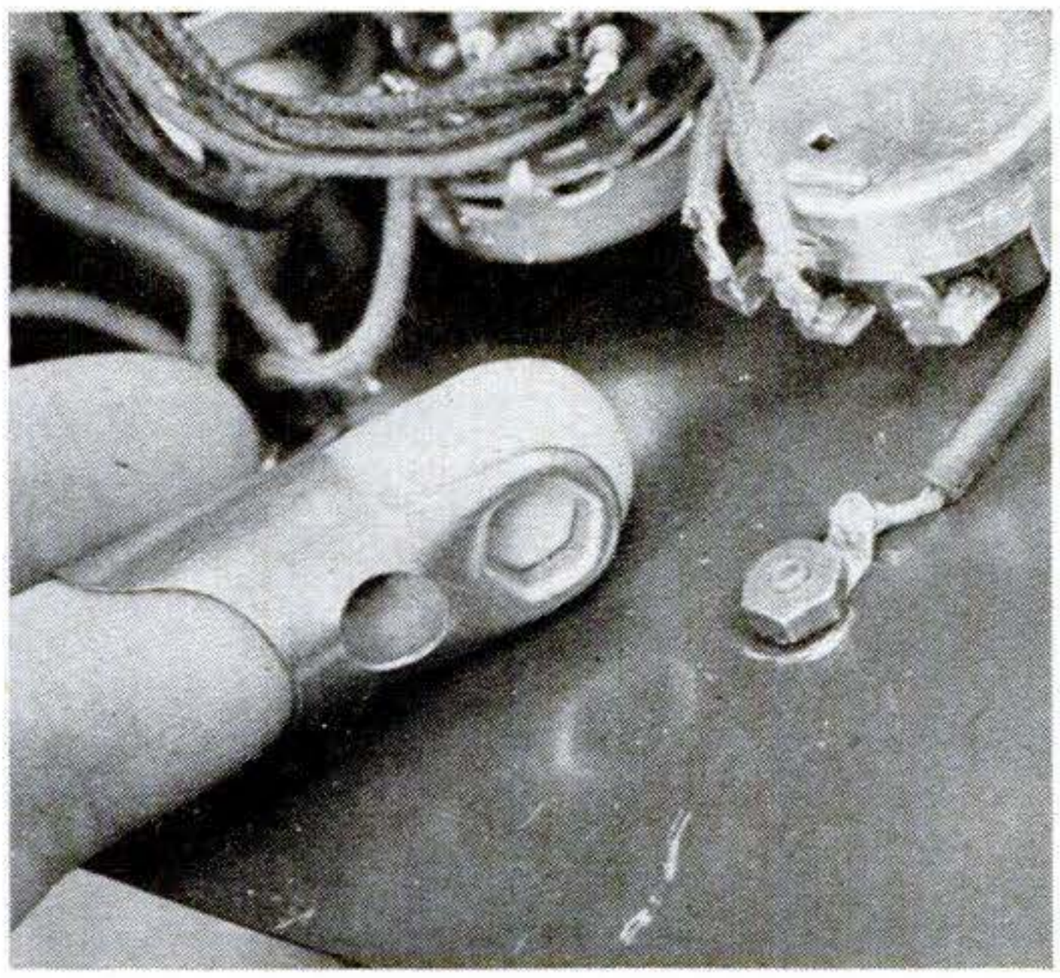
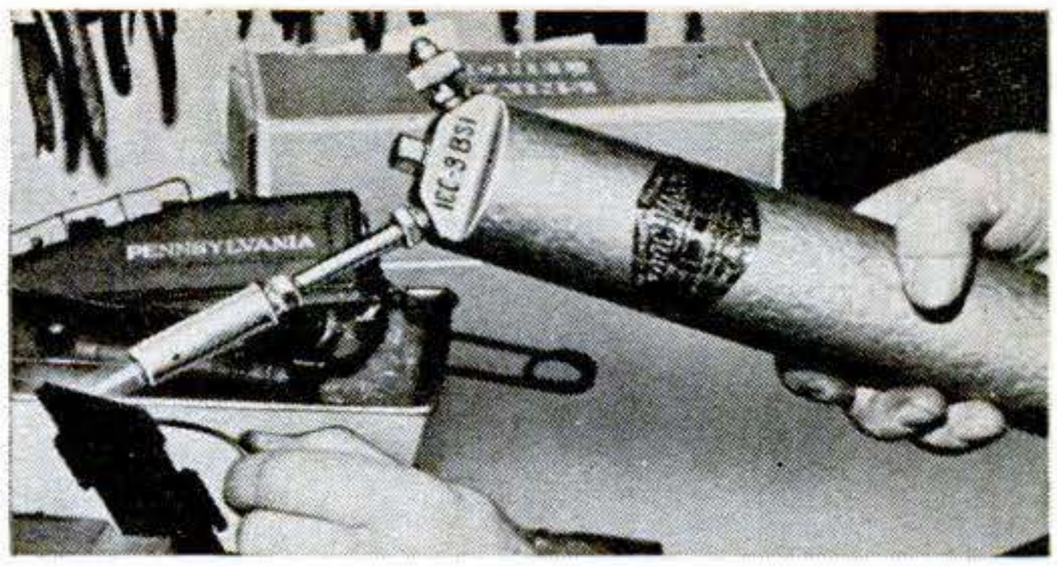
NEW TOOLS



Saw Cuts Own Starting Hole. Fitted with a 1/10-hp. motor, this hand-guided power saw cuts wood, plastic, hard rubber, asbestos board, and similar materials up to 1″ thick. The motor delivers 3,250 cutting strokes a minute. A patented blade permits cutting directly through material without drilling a starting hole or sawing in from an edge. It rips, crosscuts, and handles curves down to ¼″ radius. Made by Forsberg Mfg. Co., Bridgeport, Conn., the saw sells for about $50.

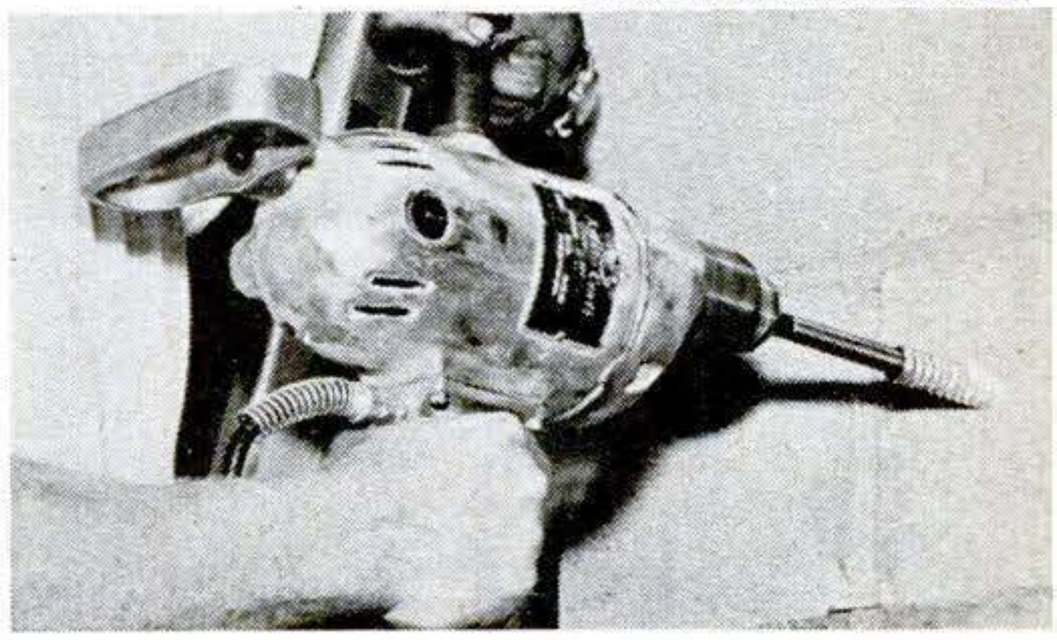


Wrench Fits on Finger. The finger wrench above puts your sense of touch to work in tight spots or out-of-sight areas. F. E. Redfield, Dumont, N. J., makes them to fit hex nuts of four sizes—¼″, 5/16″, 11/32″, and ⅜″. A set of four wrenches costs about 50 cents. The wrenches are easily bent to fit any finger size.



Torch Burns Petroleum Gas. A self-contained hand torch announced by Industrial Engineered Products Co., Los Angeles, is designed for light brazing, soldering, and other heating jobs. A valve varies the flame instantly from an intense blue pencil point to a roaring blowtorch flame. Retailing for about $20, the torch can be filled from any standard butane or propane container for a few cents.

Saves Knuckles. Attached to a hacksaw, this aluminum button gives you a better front-hand grip. Because it requires you to keep your hand out of the way, the maker calls it a Knuckle Saver ®. Future Products, Portland, Ore., makes it.



Carbide Drill Cuts Rock. Drilling through a rock embedded in concrete is said to be a cinch for the RCD Bit®, a product of the Rotary Concrete Drill Co., Pasadena, Calif. As seen in the upper photo, carbide cutters are brazed into the blunt end of the cutter shaft. The cutters range in diameter from ¼″ to 2″.

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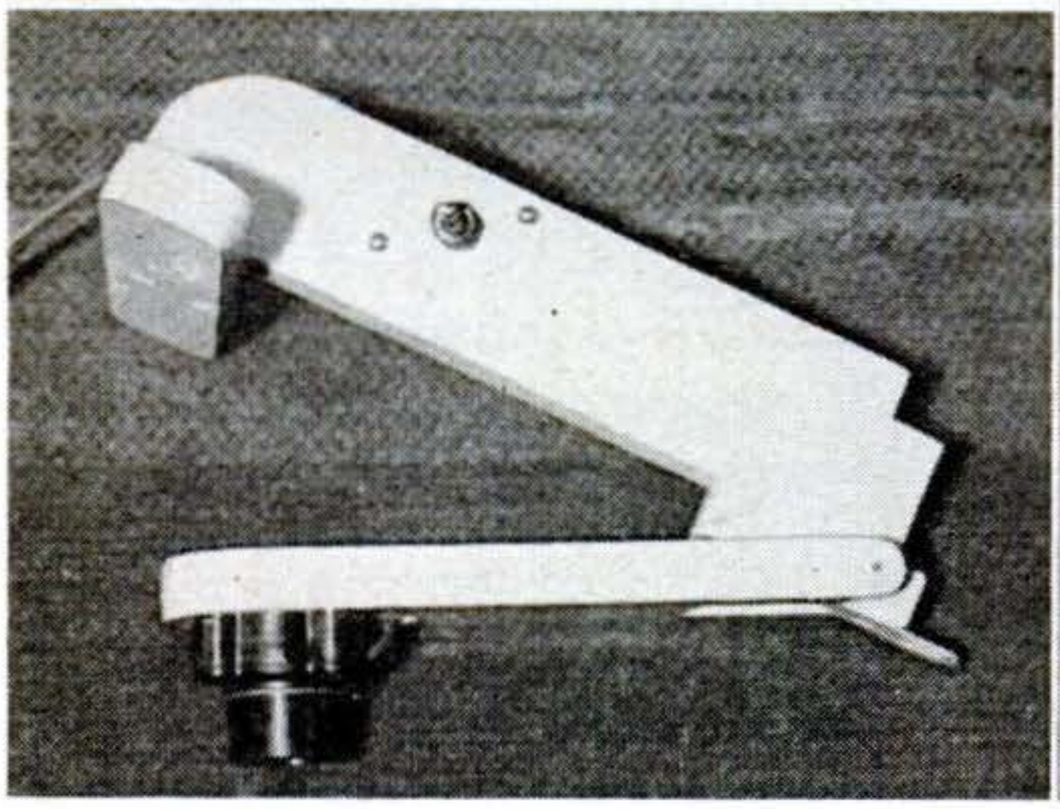
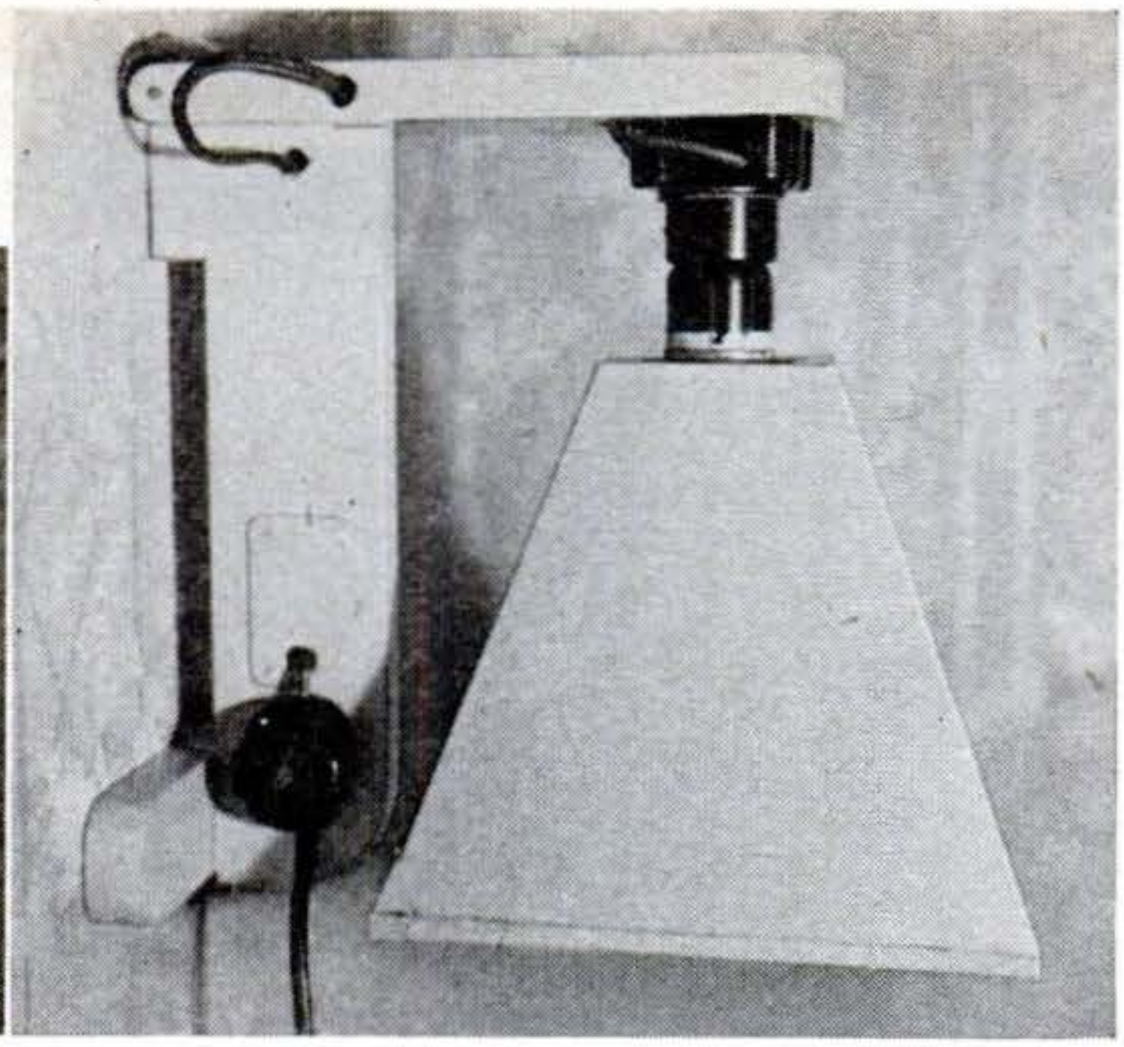


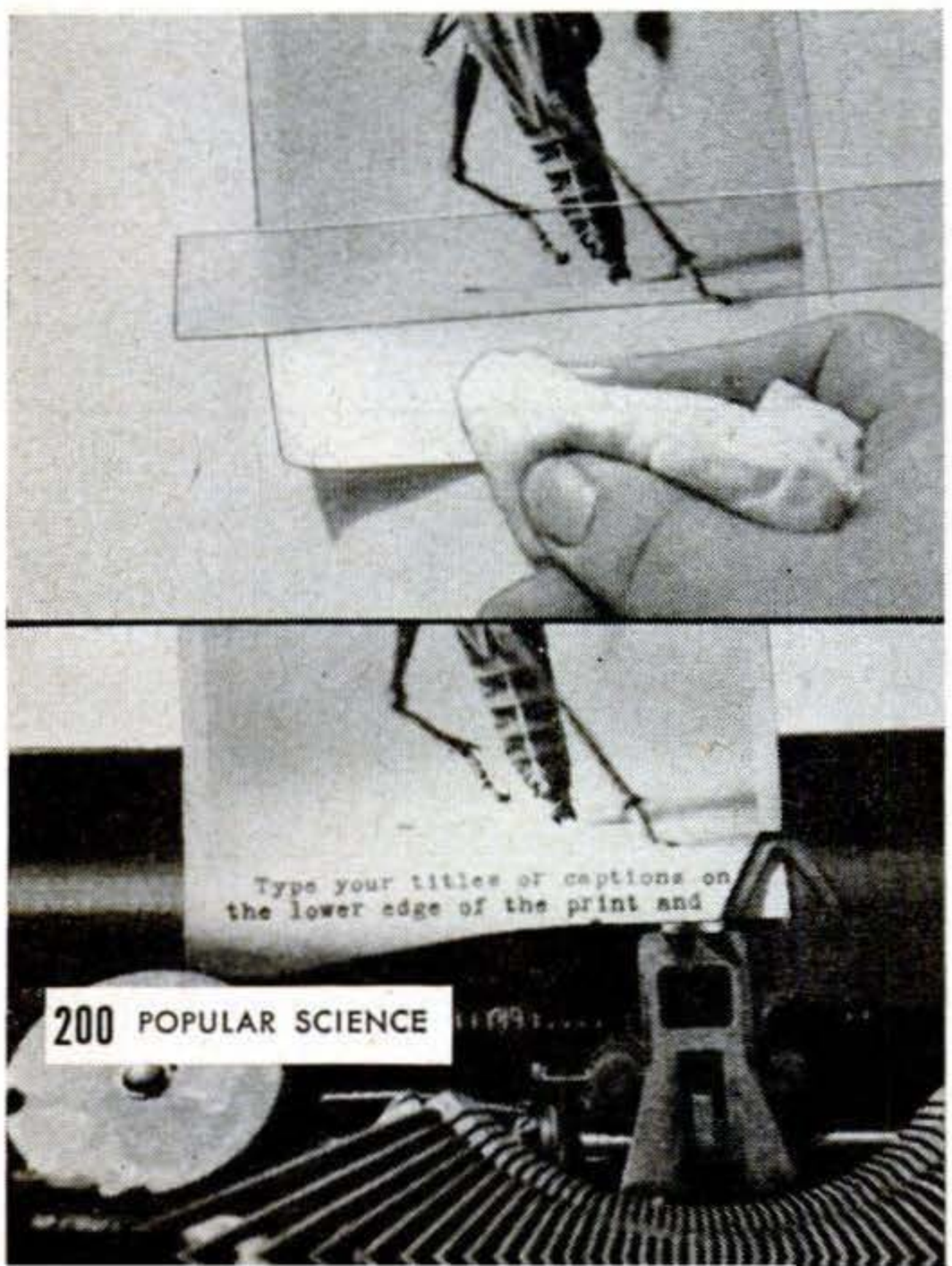


Safelight Bracket Folds Up. This safelight bracket was designed to make it easier to set up and take down photo equipment in a kitchen darkroom. As seen above, the bracket folds for more compact storage. A toggle switch on one side of the vertical arm controls the screw-in kind of safelight. A convenience outlet on the opposite side takes the plug of the enlarger cord. Hence one kitchen outlet is all that's needed to supply both the safelight and the enlarger. A nail in the wall supports the bracket.

The slotted horizontal arm pivots through almost 360°, coming to rest on a stop atop the other. Wiring was run through the wood parts, but insulated staples could be used instead.—*John M. Avery, Dexter, N. Y.*

Titles Typed on Prints. By removing part of the emulsion from a glossy print, you can type a title or caption directly on the face of the picture. A solution made by diluting ordinary household bleach with water will take off the emulsion. Mask off the area to be treated, dip cotton in the solution, and wipe lightly over the area. Pick up excess solution with blotting paper. —*B. E. Reese, St. Petersburg, Fla.*

Liquid Mask Peels Off. Applied as a liquid, a product marketed by Andrew Jeri Co., Inc., New York, forms a peelable mask for local toning, reducing, intensifying, or retouching. Put on with brush or pen, it dries in five minutes on either prints or negatives. Red in color, the product also will serve for opaquing negatives. Below, it's used to protect figure while background is bleached from negative.



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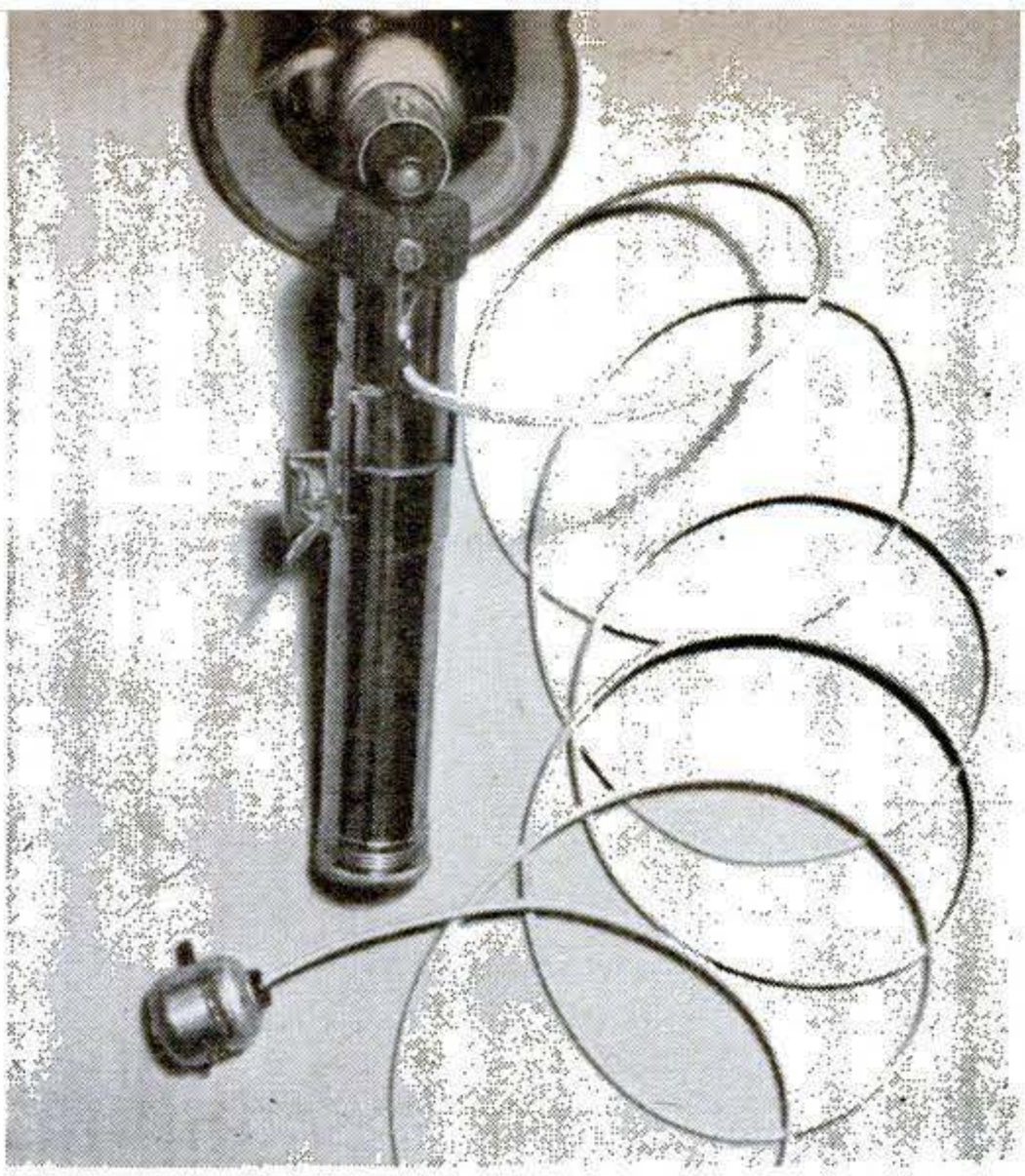
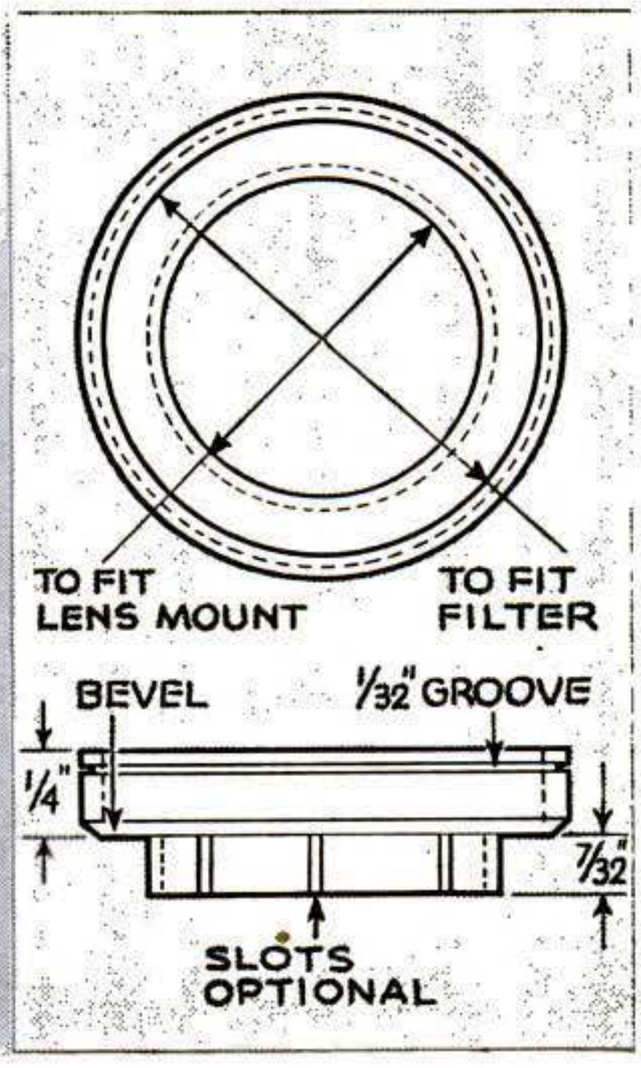


Remote Switch Sets Off Flash. An extension cord ending in a switch lets you stand away from the camera to operate a solenoid-actuated flash synchronizer. You can make up the outfit from a plug, about 10′ of wire, and a switch. Instead of the switch shown, however, it's better to use a momentary-contact type so that the current can't be left on in the solenoid.

New Slides Have Depth. When projected on a screen or viewed in a twin-lens viewer, new 2″ by 2″ photographic slides now on the market are said to give a sense of having a third dimension—if you look through a pair of Bi-Color-Scopes®, shown in the model's right hand above. Slides and Bi-Color-Scopes are offered by Horner-Cooley Productions, Hollywood.

Filters Improve Box Camera. With a box camera, as with more elaborate ones, a filter will add clouds to your negatives. If you have access to a lathe, you can make a filter adapter like the one shown. This was turned from aluminum bar stock to take Series VI Wratten® filters in a light press fit. The rear ring of the adapter must fit snugly on the lens mount.—*A. C. Kubitz, Millbrae, Calif.*



Locating Diaphragm Stops. The luminous paper that's sold for marking electric-light switches will locate diaphragm stops on your enlarging lens. Put one tiny piece on the barrel index mark, and others by the commoner settings.

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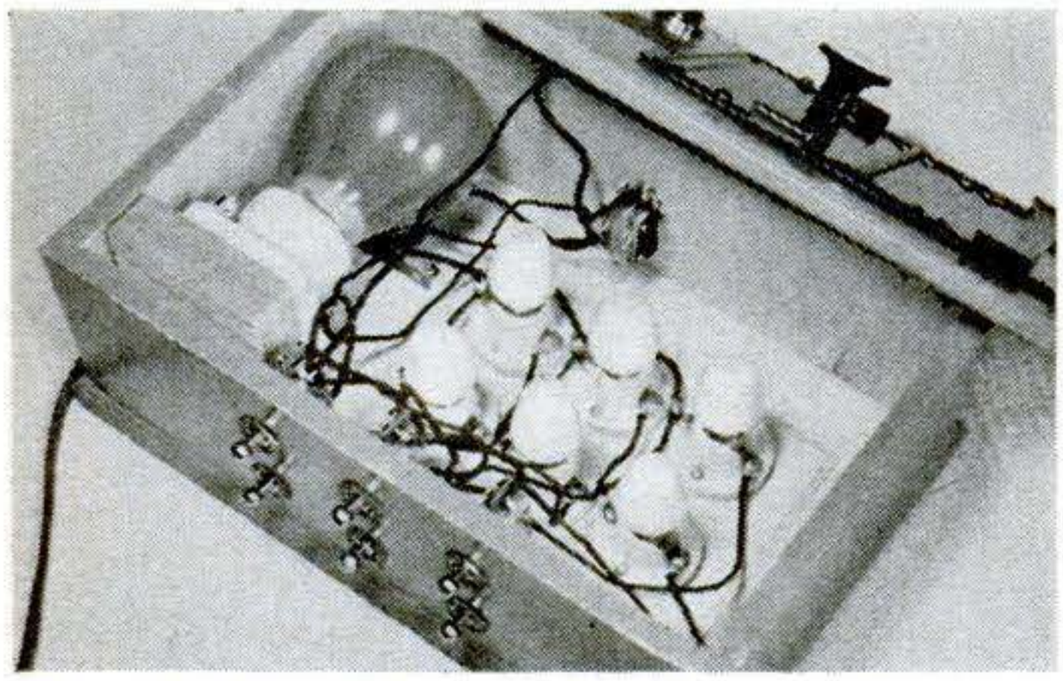
Light on printer blinks at intervals of about 1 sec., giving an accurate count for timing exposures. Pressing down knob as above operates a snap switch, which turns on the printing lights.

Contact Printer Times and Dodges Photos

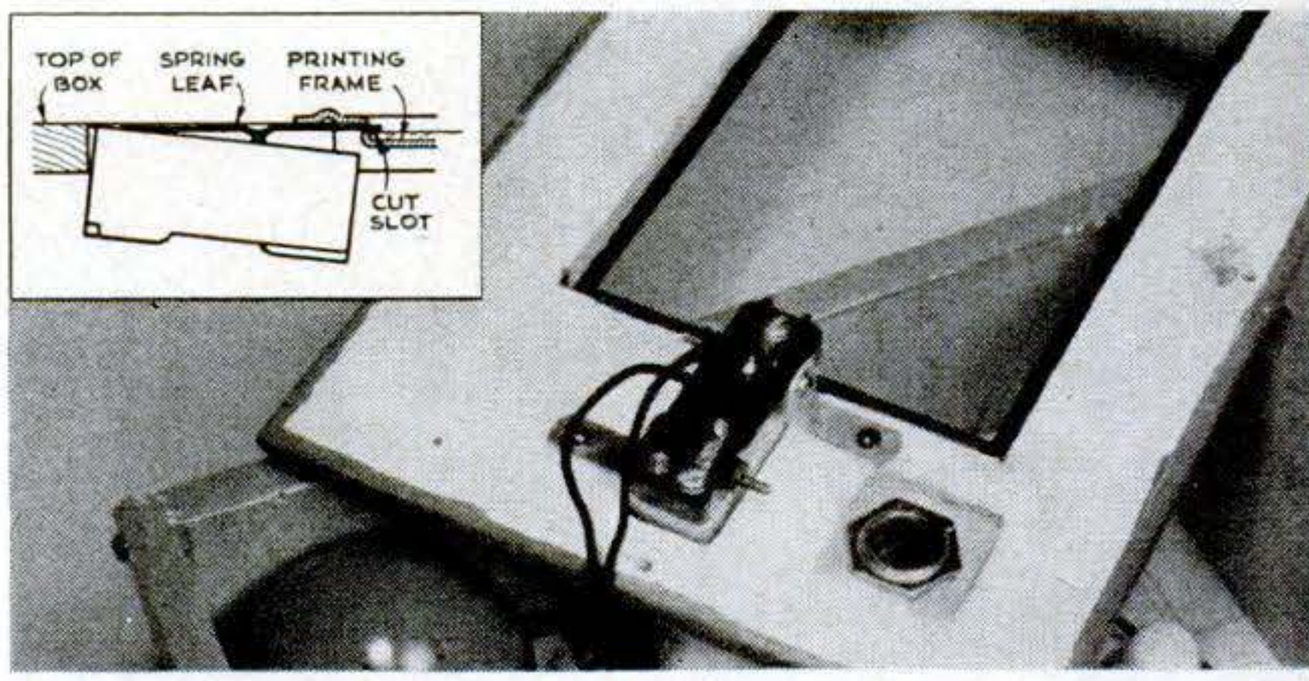
By Arthur C. Miller

WHEN you use this contact printer, there's no need to count "1,000-and-1" over and over to time your exposures in seconds. You simply count the flashes of a blinking glass jewel atop the printing box.

Six 7½-watt bulbs, wired in parallel, do the printing. Individual switches allow you to turn on lights according to the density of different portions of a negative. This gives printing control similar to the dodging done in enlarging.



Six printing lights under the negative area operate by individual switches. This permits dodging. Note knob on printing-frame cover.



Snap-action switch is held by two metal brackets. It requires careful mounting so that depressing printing-frame cover will operate spring leaf.

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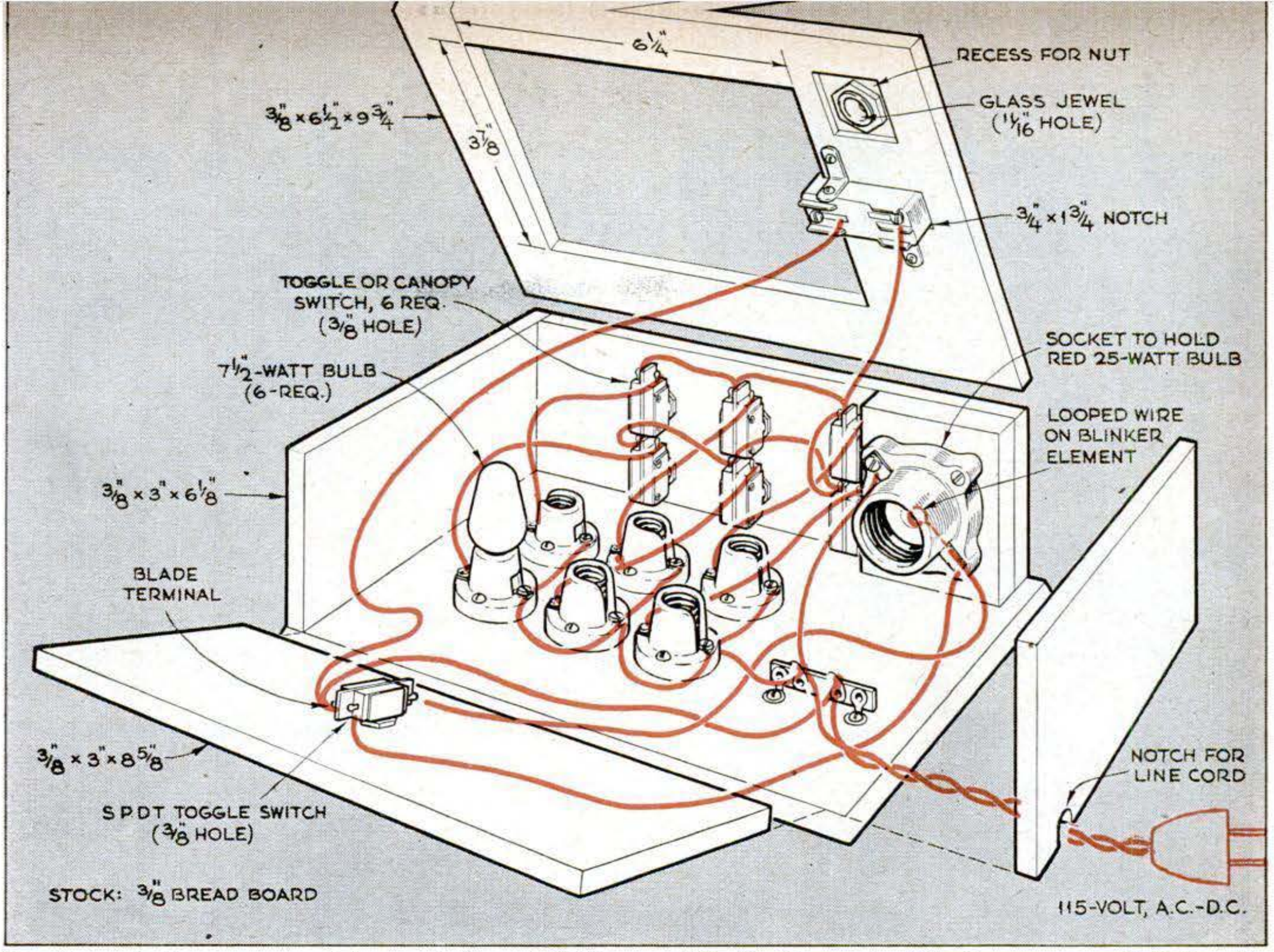


Single switch on near side controls safelight blinker. When switch is in one position, the red bulb glows steadily for use as safelight. In the other position, the light flashes for timing.

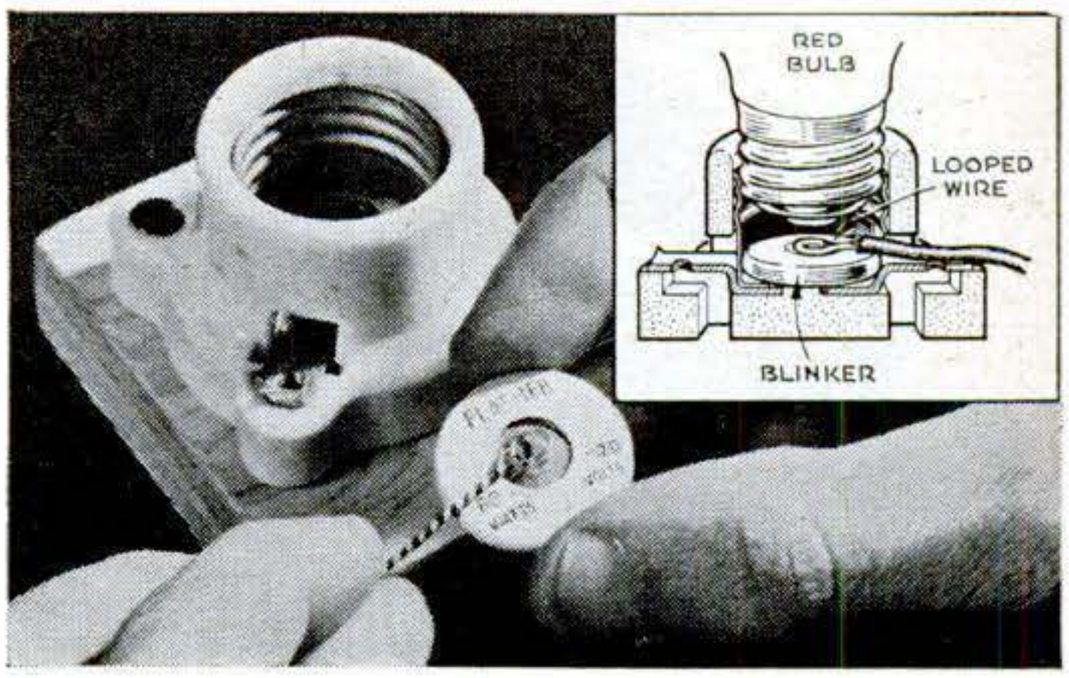
All parts of the box were cut from two ⅜" by 9¾" by 13" bread boards. A 3¼" by 5½" metal printing frame is fitted into the top of the box, the edge being drilled for screws. Remove the spring from the shorter half of the frame cover and replace with a small drawer knob.

Cut a slot in the frame to allow passage of a snap-switch spring leaf. Mount and adjust the switch and printing frame so that depressing the knob firmly actuates the switch to make exposures.

Group candelabra-size sockets for the printing bulbs under the center of the printing-frame opening. Also mount a socket for the 25-watt safelight bulb on a ¾" by 2¼" by 2¼" block. Attach this block with screws through the bottom of the box. Because the fit will be tight, remove the block when replacing the safelight bulb.

In one position, the single toggle switch on one side of the box cuts the blinker out of the circuit, allowing the safelight to glow steadily. When you switch from steady to blinking light, the bulb will go out temporarily and then begin flashing.

Lights are adjusted in this way for dodging. With a mask and negative in place, they are turned on or off to suit the negative density.



Looped wire atop flasher provides timing circuit. Wire runs out of hole in socket. Screwed in, bulb holds loop in contact with blinker.

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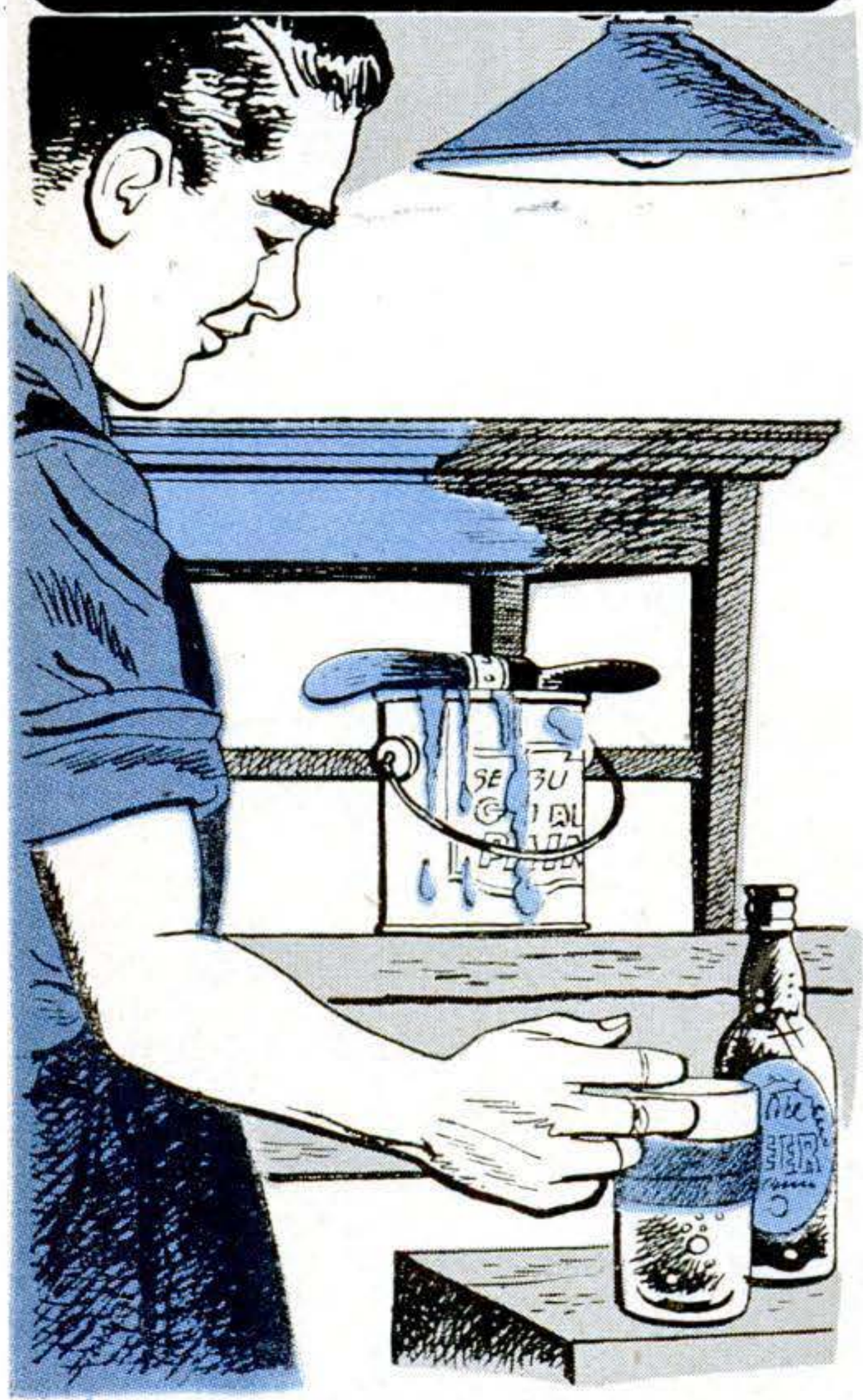
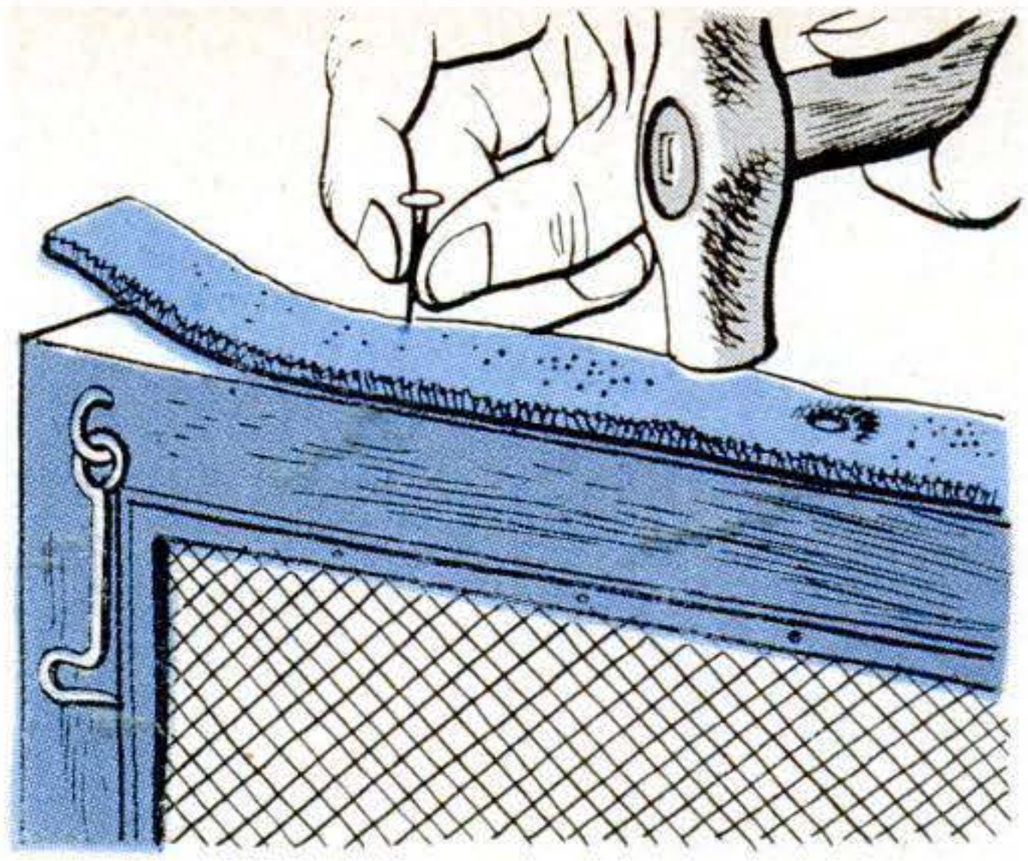
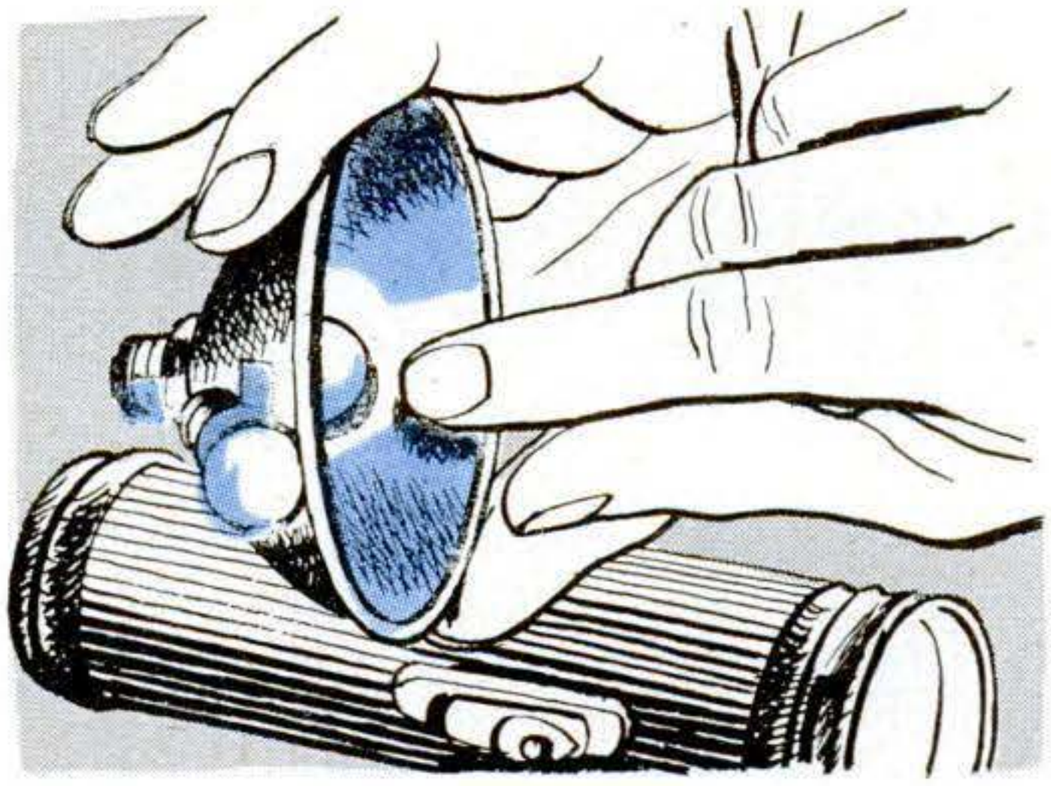
Keeping the Home Shipshape



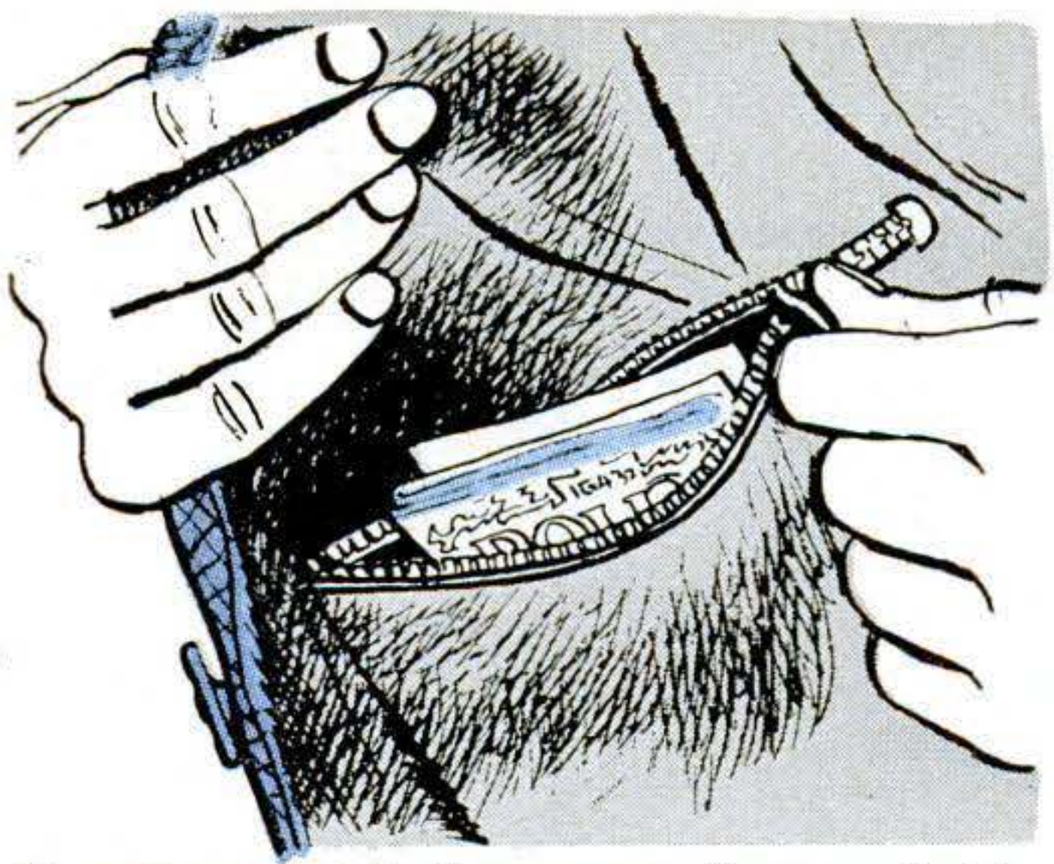
If you like a cold drink while painting, wrap a band of masking tape around the glass. There will be no need to scrape paint off later; just strip the tape to clean the glass.



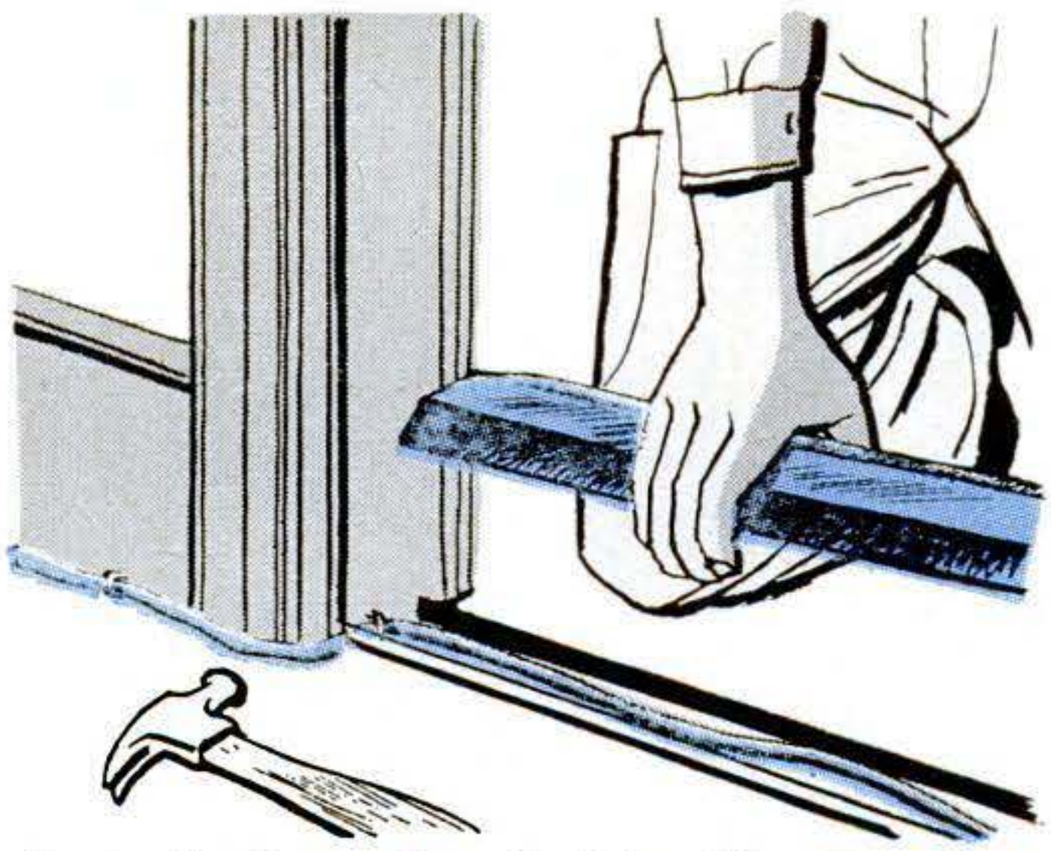
Window screens aren't much good if tiny insects can get around them. Fix those ineffective screens by tacking weatherstripping along edges that fit loosely in the window frames.



Own a 3-cell flashlight? Tape an extra, smaller bulb to the reflector for future use. As cells run down, 2.5-volt bulb will light brightly when 3.8-volt bulb hardly glows.



Guard against losing papers from an inside coat pocket by attaching a slide fastener. It's especially good protection in the summer, when you're apt to carry a jacket on your arm.



Instead of carrying electric wiring for extension outlets over the top of a door, remove the sill and replace it with electrical conduit of the two-piece molding type illustrated.

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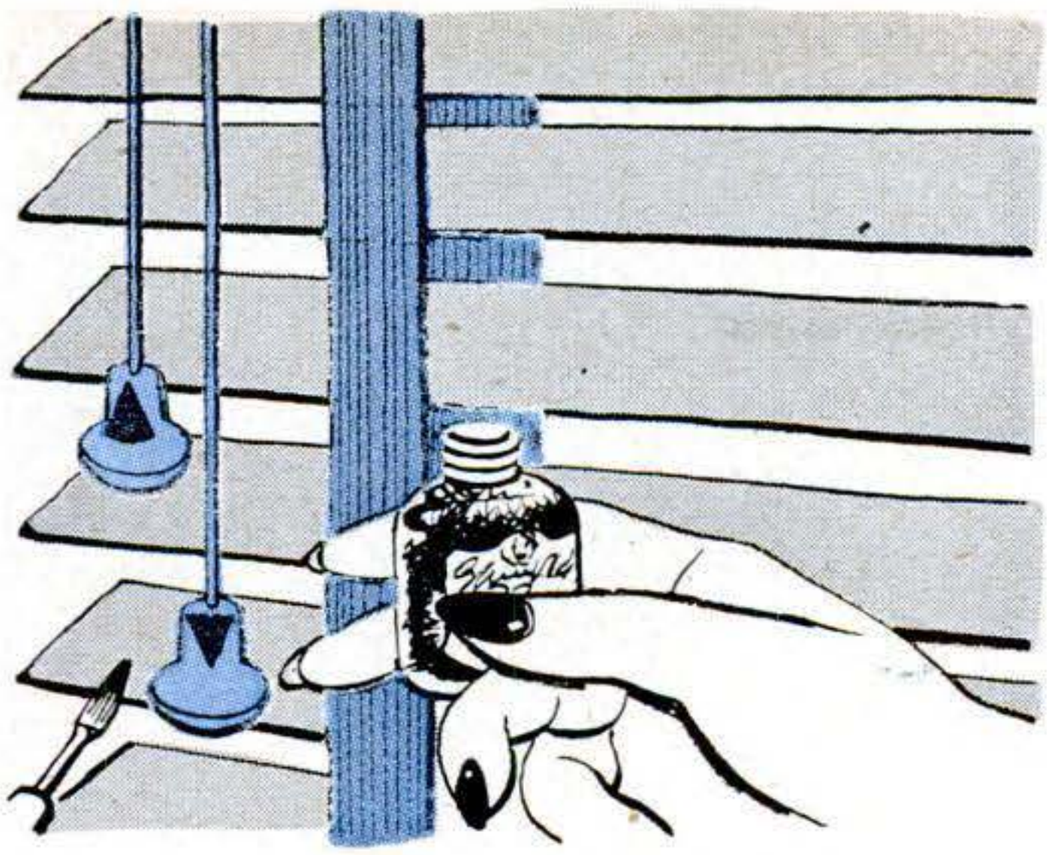
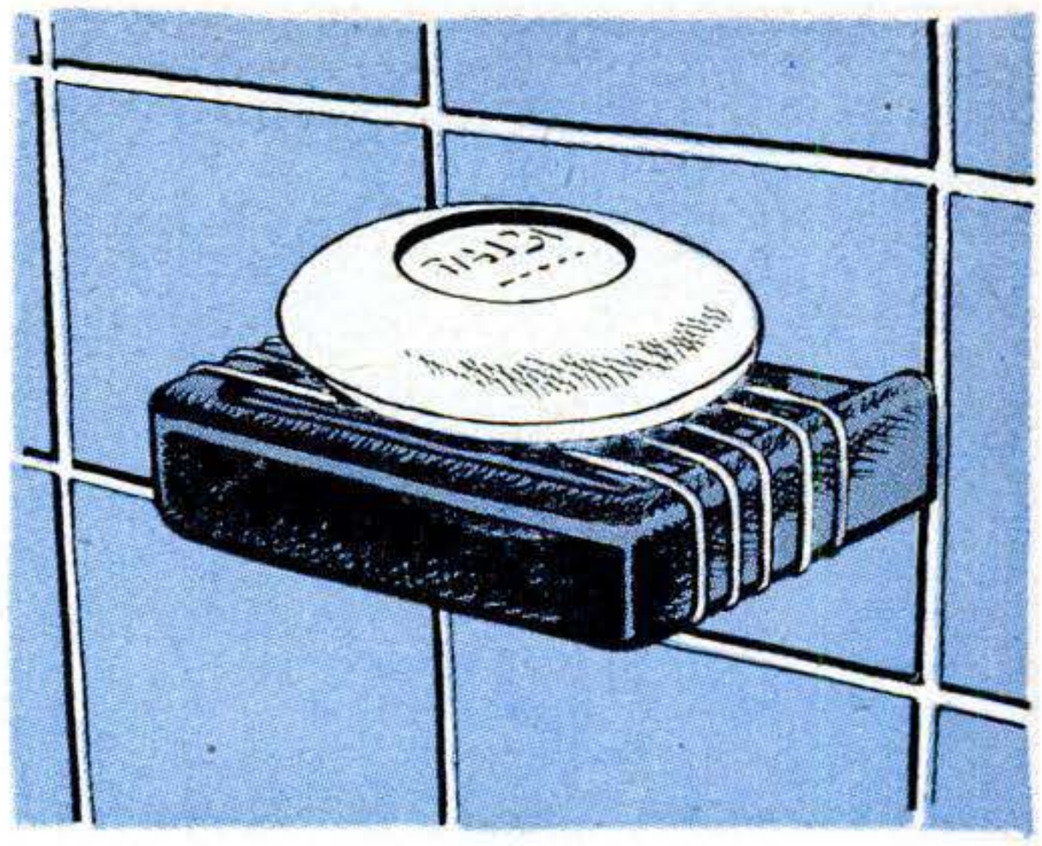


To distinguish at a glance which cord of a Venetian blind tilts the slats up and which tilts them downward, paint an identifying arrowhead on each pull with nail polish.



As a soap saver, stretch three or four rubber bands around a soap dish as shown. They keep the soap high and dry. Allowing it to dry between times makes soap last longer.

A nutcracker kept handy in the medicine cabinet will help you open stubborn screw caps in a hurry and save extra trips down to the kitchen or basement looking for tools.

Ends of drape material and other large fabrics often must be squared before the piece can be measured. A newspaper laid evenly along an edge gives a true line on the end.

About an hour before serving ice cream in hot weather, try putting the dishes in the refrigerator. Chilled plates will help keep it from getting soft and soupy before it can be eaten.

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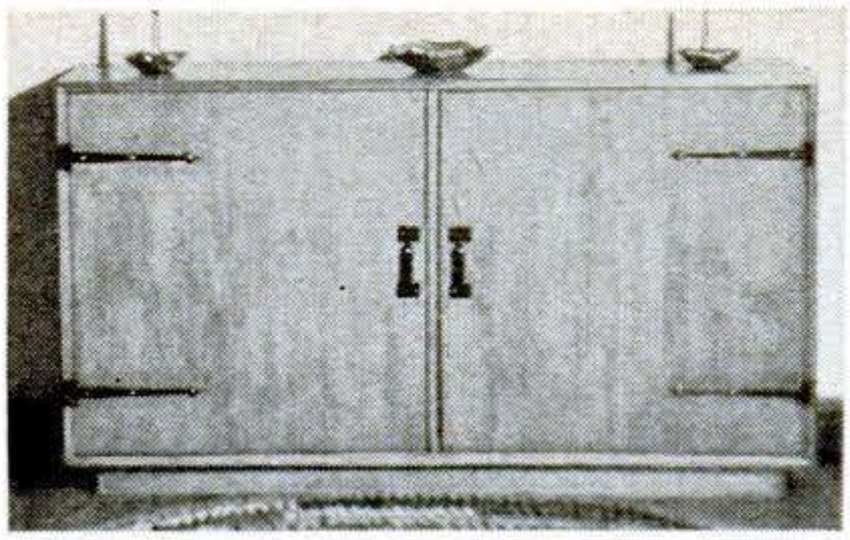

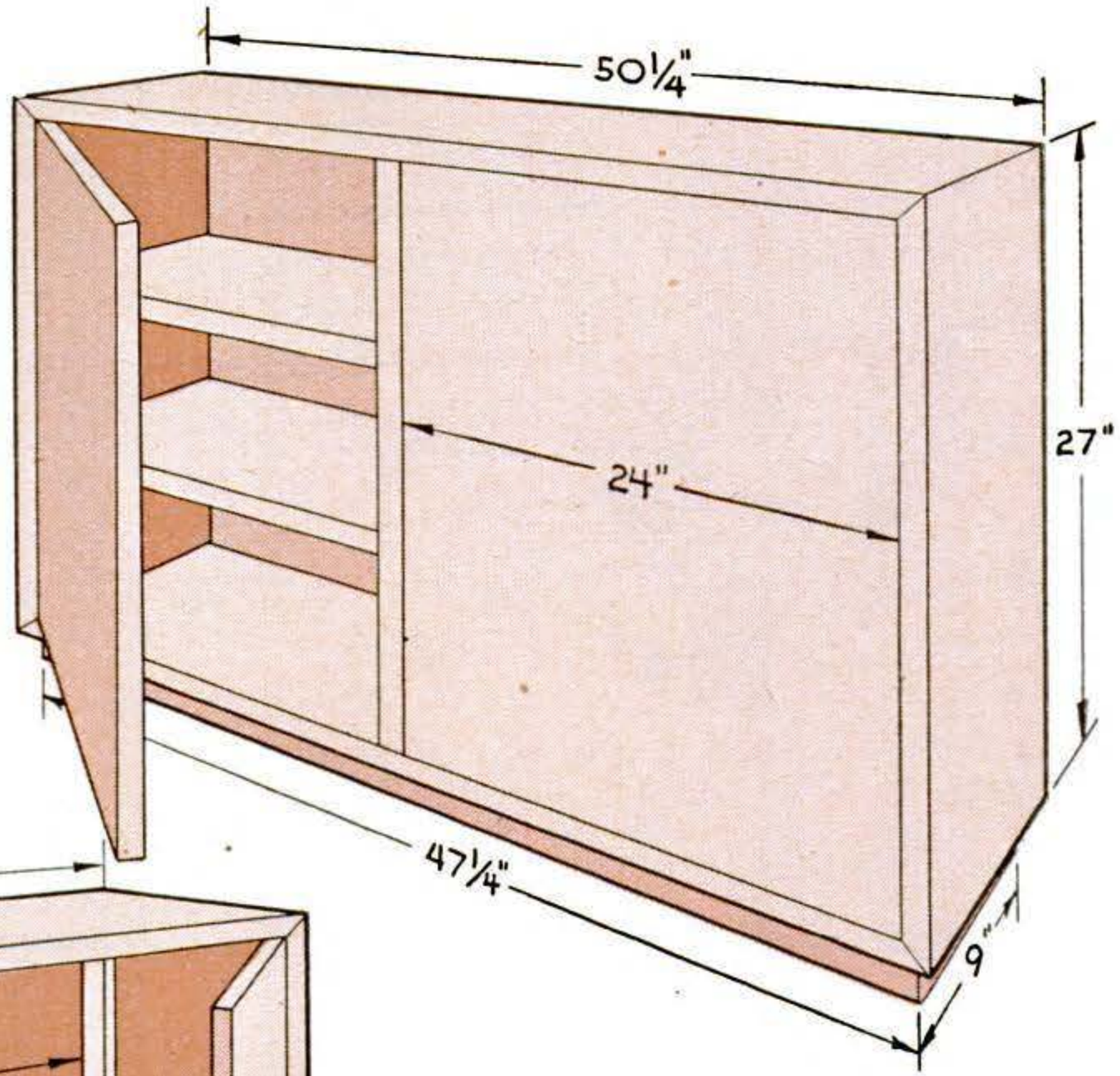

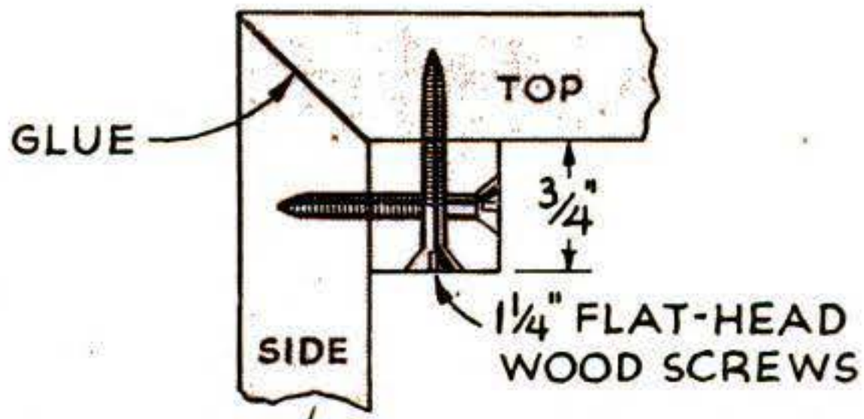

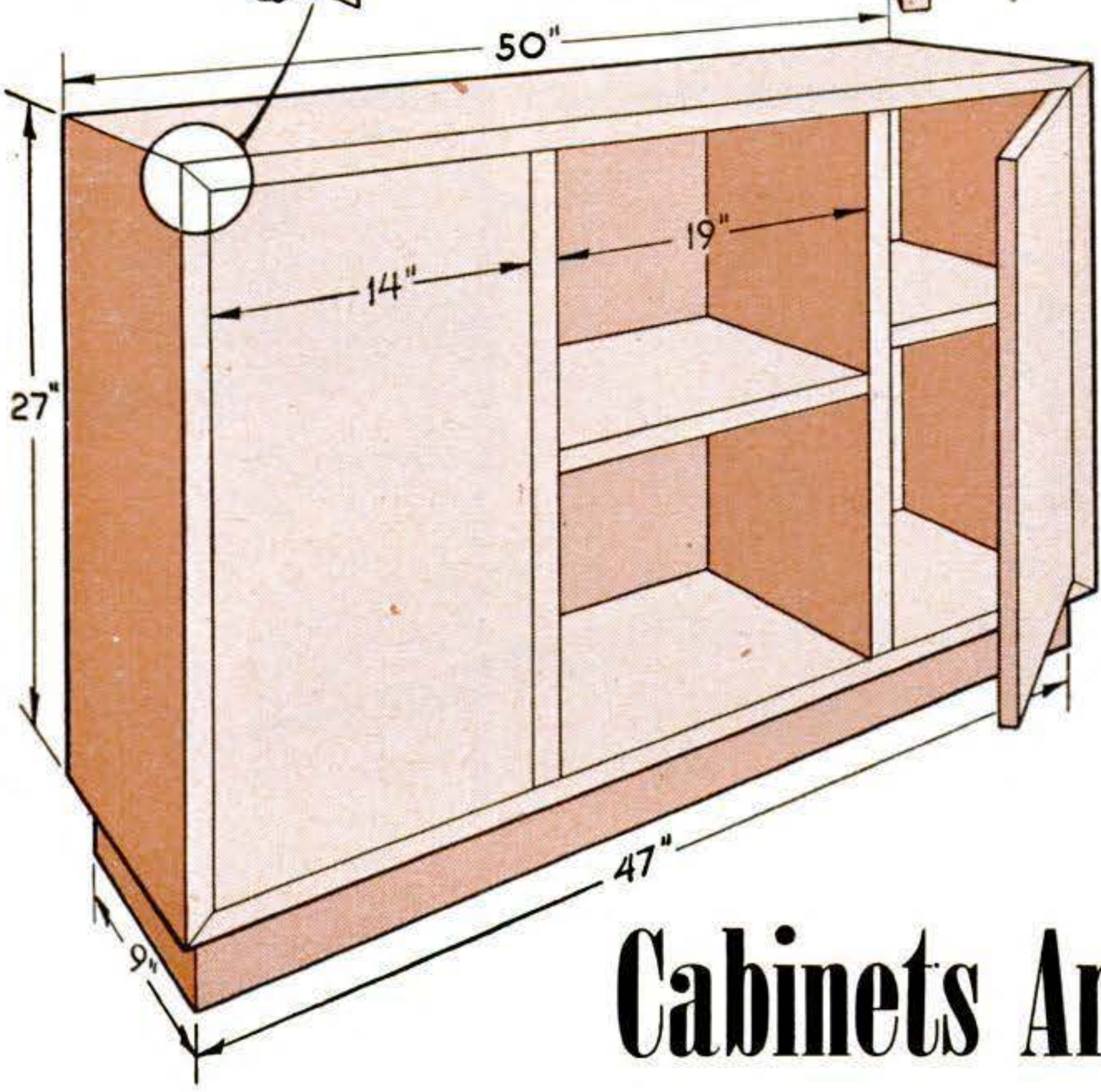

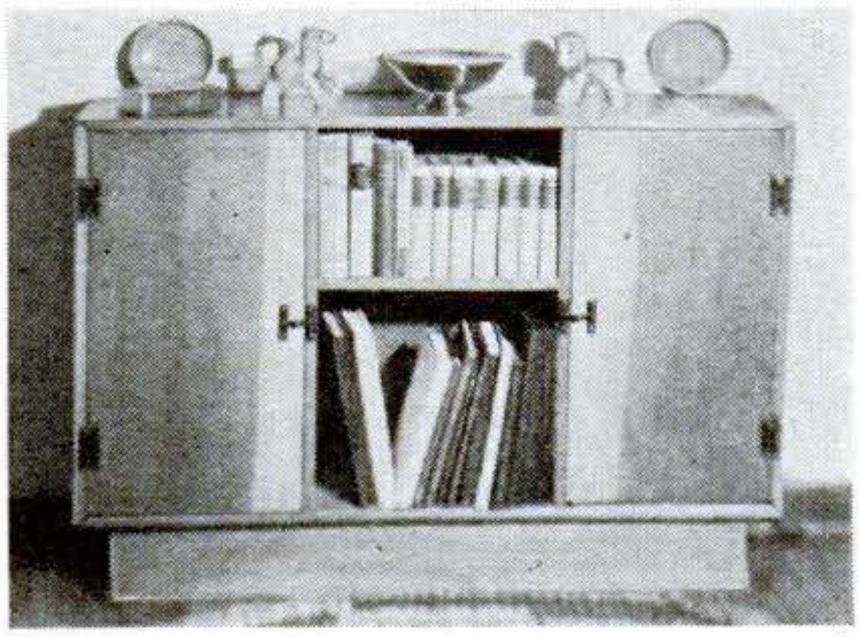

Cabinets Are Hand-Tool Job

WHILE these cabinets take up wall space, they don't obstruct traffic through the room. Deep enough to hold big books and even 10″ record albums, they still hug the wall. Both have the same basic design, open shelves in one occupying a center section. Built with hand tools, the cabinets have proved very useful in supplying needed storage space.

Twenty feet of 1″ by 12″ clear white pine went into each cabinet, plus the extra footage for shelves and partitions. The large cabinet doors are white-pine plywood. The small doors are 1″ by 14″ pine, battened to resist warping. For economy and lightness, the backs are hard composition board. Corner construction—mitered, glued, and screwed—is shown in the drawing. Shelves are supported by ¾″ by ¾″ cleats screwed to ends and partitions.

The only difficult part in construction is mitering the corners. However, most lumber yards that do mill work will cut them for you at a small price. (I paid 35 cents to have eight ends mitered.) You can obtain a nice finish on white pine by brushing on three coats of orange shellac, rubbing each coat when dry with fine steel wool. Finally, apply a coat of wax. This turns out a mellow, wheat-colored finish that goes well with the black forged-iron hardware. The bases are recessed.—*Robert C. Gass, Toledo, O.*

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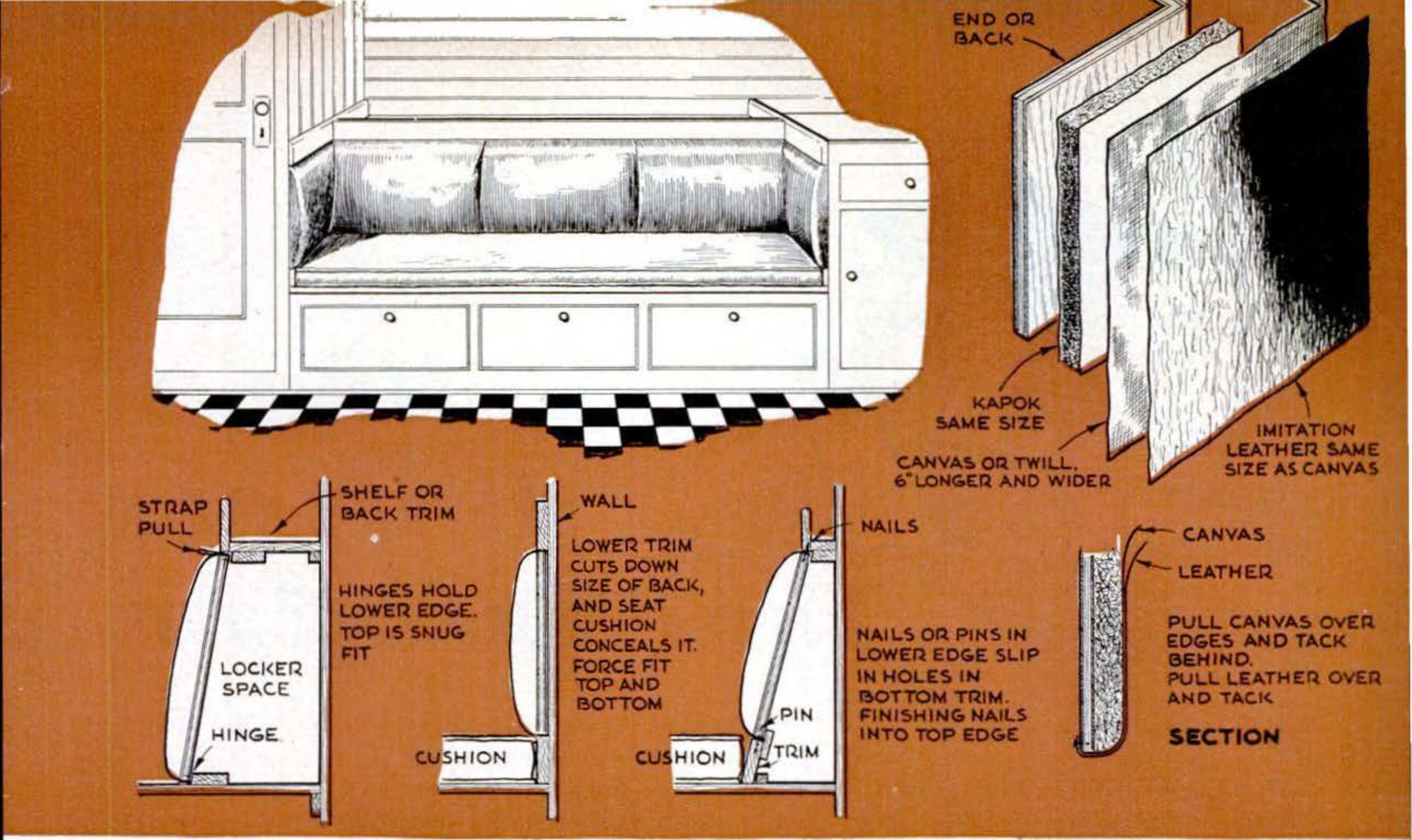

Building Padded Seat Backs

PADDED seat backs not only dress up a room but add comfort. You can fit them in any built-in seat—in a den, playroom, breakfast nook, or aboard a boat.

Ends, too, may be padded. In laying these out, allow for any slant that you may want to give the back. Build up the backing boards of 1″ solid stock, using edge battens, or use ½″ or heavier plywood. Make each panel ⅛″ undersize all around to give clearance for turning the edges of the covering.

Upholstering moss or kapok may be used as a filler. This should be covered by canvas and then leather, imitation leather, or plastic fabric. Lay a 3″ layer of the filling to cover the board completely. Then put on a piece of canvas large enough to be pulled over all edges and tacked. Turn the whole business over and kneel on the board to compress the filling. Pull the canvas tightly and tack. Follow with the final covering. Space the tacks 1″ apart.

The drawing shows three arrangements for seat backs. The one with the locker space may be in three sections, the side ones permanently fastened and the center hinged so you can get at the space behind. Ends that adjoin closet or locker walls can often be fastened with screws from inside the closet.—*Jim Emmett, Harryhogan, Va.*

Picnic Carrying Case Doubles as Table

AFTER the food tray is removed from this case, five wooden legs lock into position to convert it into a 26″ by 26″ table about 1′ high. When closed, the case measures 6″ by 13″ by 26″. It is constructed of ¼″ plywood with all outside edges bound with metal rails. Corners are reinforced. A clear plastic coat over the outside resists salt-air corrosion. The inside is lined with a washable, stainproof fabric. Table-Pack Co., New York City, prices the case at about $16.

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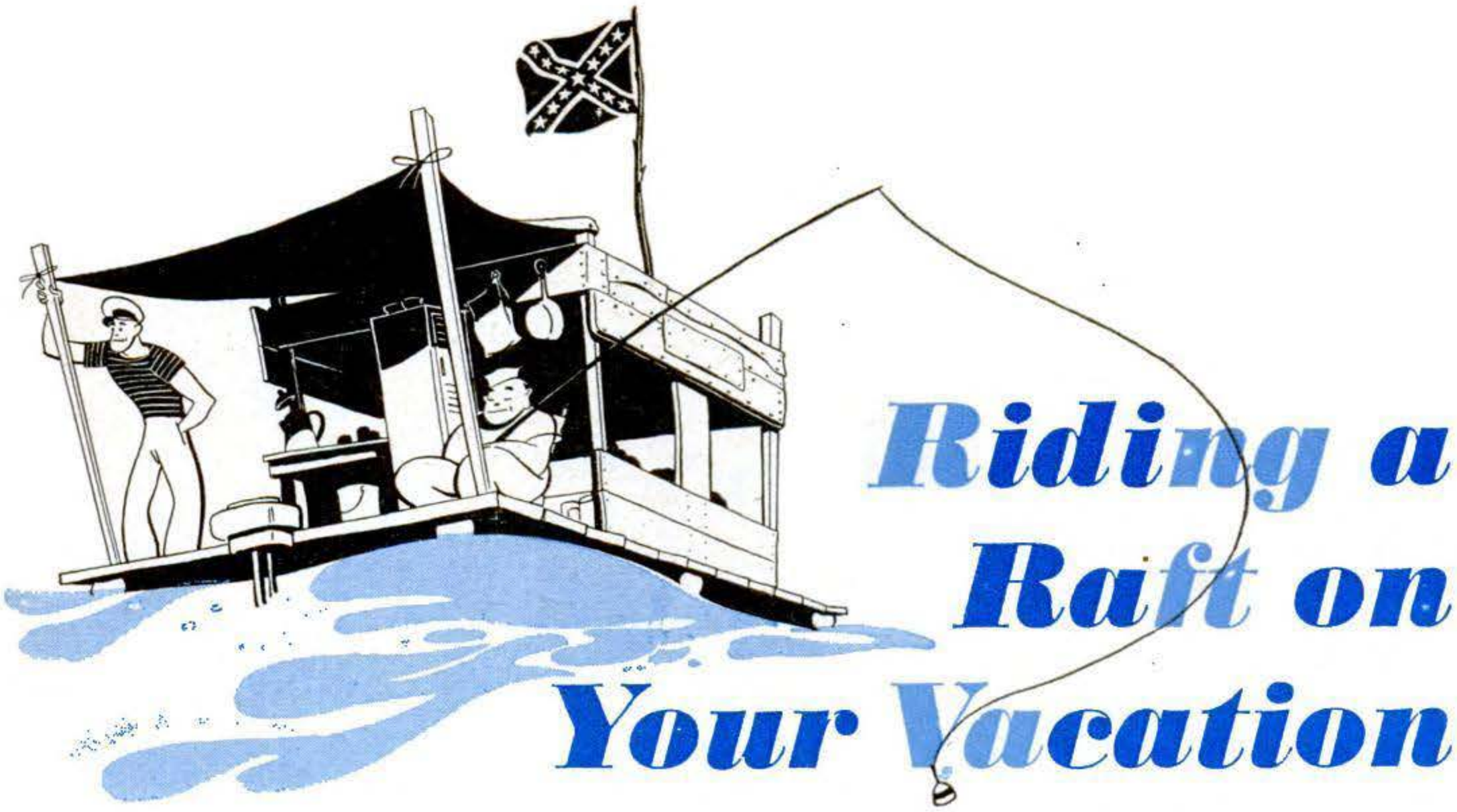


Riding a Raft on Your Vacation

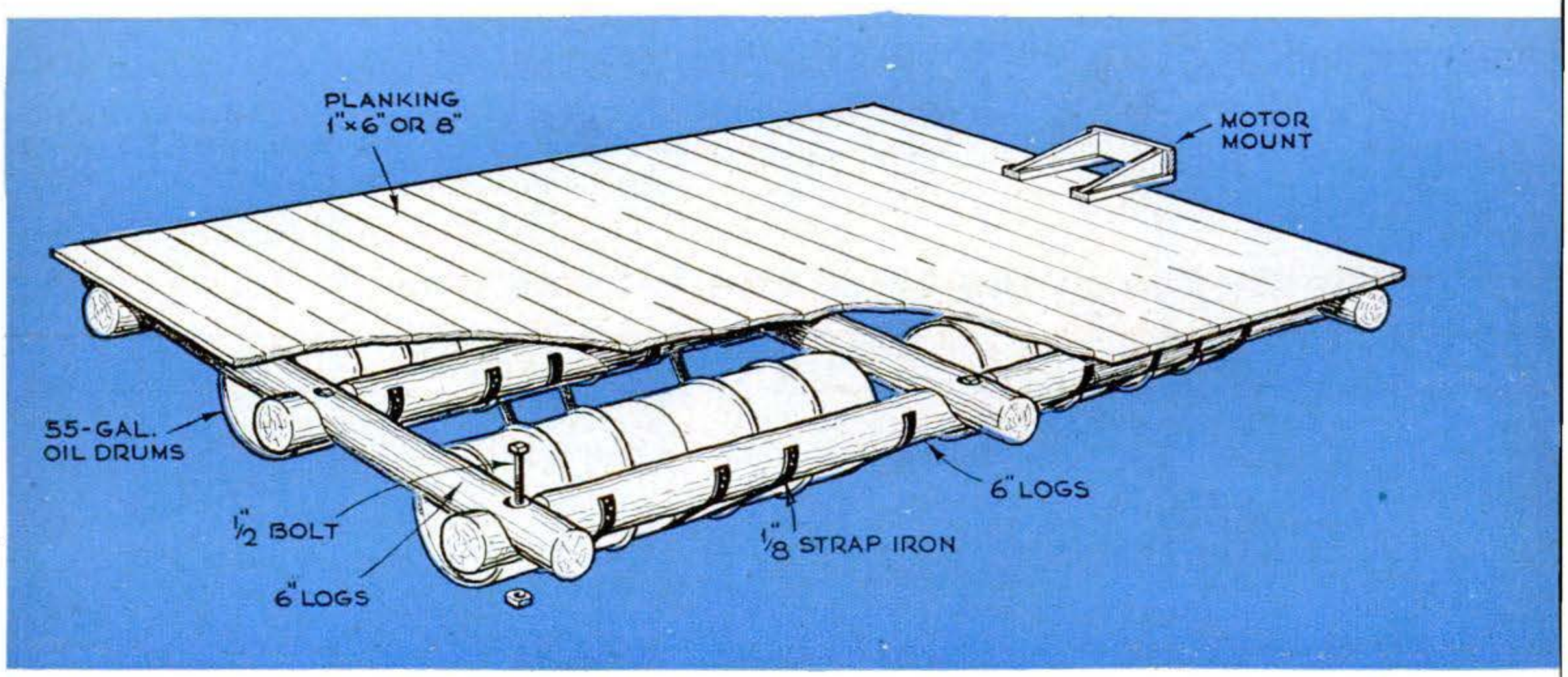
By W. D. Hull, Jr.

TOM SAWYER and Huckleberry Finn had a lot of fun cruising down a river on a raft. It's still a fine way to spend a comfortable, take-it-easy vacation, especially if you're not in a hurry to get anywhere.

We rafted 600 miles, from Shreveport, La., to New Orleans, drifting down the Red, Atchafalaya, and Mississippi Rivers. Only one modern convenience—a 1½-hp. outboard motor—went along. We used it to kick the raft in and out of the current or to get to the bank. Otherwise, our supplies were pretty much the same as those carried by Mark Twain's characters: cornmeal, bacon, eggs, and fishing tackle.

Building the raft is a simple operation. Ours was afloat in 10 days, and we only worked on it in our spare time. Total cost—outboard excepted—was $150. Six-inch logs made the frame and 1″ by 6″ or 8″ rough planks formed the deck. Rough hardwood is just as good as planed stock and it's cheaper than the finished stuff. When you nail down the planking, fit the boards as closely together as you can.

Length of the logs is not too important. Our raft was 10′ by 14′ but you can make yours longer and wider if you want. It depends on how many people are going on your expedition (there were two on ours). Run three logs the length of the raft and three the width. Notch them with an ax



Construction is simple. Six 6″ logs, bolted together and covered with planking, form the main frame of the raft. Strap iron bridging the logs holds the 55-gal. oil drums securely in place.

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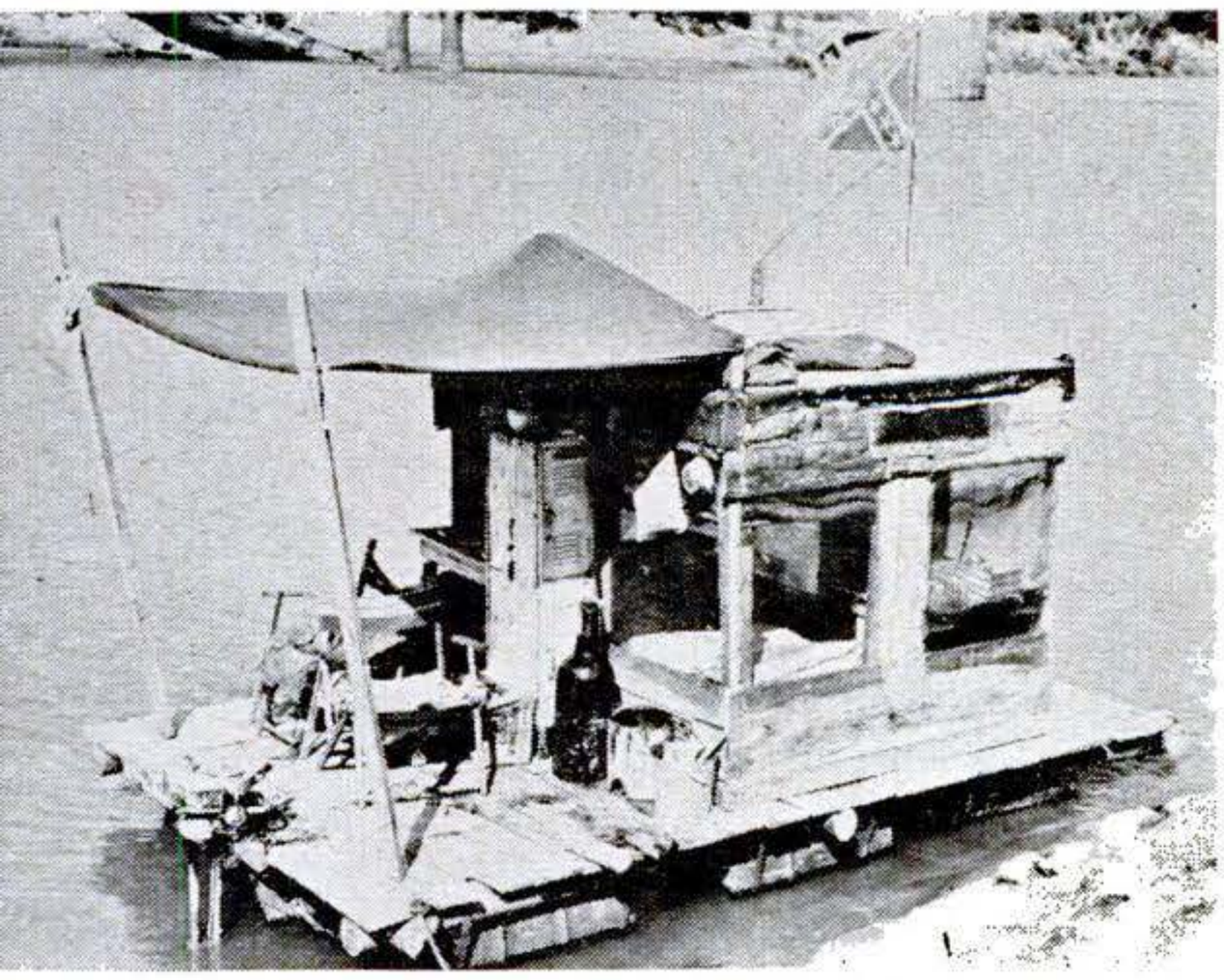
where they meet and hold the joints with ½″ bolts as shown in the drawing. This type of construction is solid enough, but for extra strength better string No. 9 wire diagonally between each section formed by the logs. Turnbuckles will tighten up the wire for you.

If you haven't built your raft near the water, drag it there now. With the logs bolted together and the planking nailed down, it'll be pretty heavy. Next step is to lash the 55-gal. oil drums under the raft. We used 10 drums and held them in place with ⅛″ by 1″ strap iron screwed to the logs and bolted to the underside of the planking.

Cabin dimensions will have to suit your framework, but build it big enough for a couple of bunks. Double bunks will save space. Locate the cabin toward the forward end of the raft, as shown in the photo at the bottom of this page. The cabin is simple: uprights with boards around the lower part and screening around the upper section. The planked roof is covered with roofing paper. Leave space for a screen door.

To provide shade, a pair of uprights on the aft end and a tarpaulin will do. Add lawn chairs and a charcoal stove and you're ready to shove off. We made our stove by rolling sheet steel into a cylinder and welding it. About two-thirds from the bottom a piece of chicken wire was fitted in the cylinder. After cutting a vent below the chicken wire, we had a workable stove.

Of course, the raft will turn and twist as it floats with the current. It'll do this slowly, however, and turning isn't a hazard if you stay on watch to avoid other craft. END



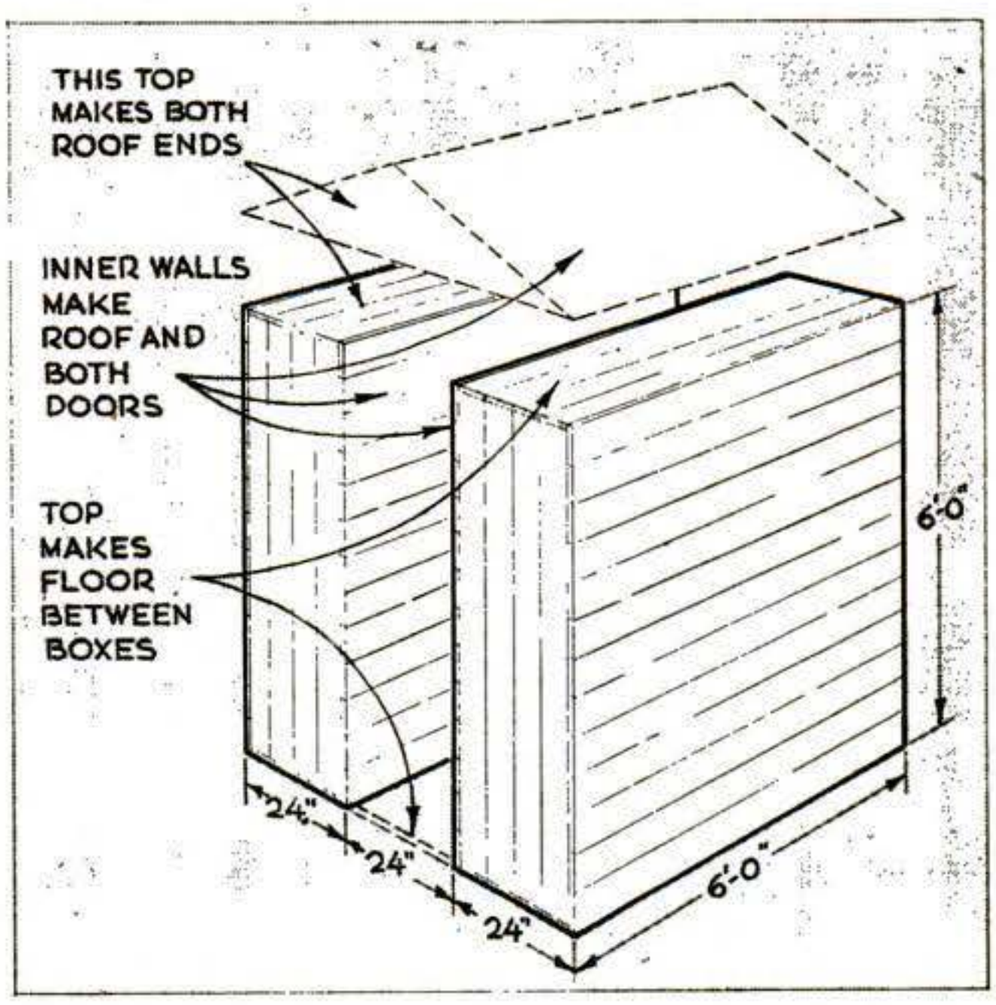
Not neat or gaudy, but double bunks in the cabin and chairs on deck make it comfortable.

Only simple tools were used to convert two baby-grand piano boxes into a big playhouse.

Two Piano Boxes Provide Lumber for Big Playhouse

KIDS get a lot of pleasure playing house, and for about $25 you can buy all the materials to build this one. Hand tools will do the job.

Get shipping boxes for baby-grand pianos, not boxes for uprights. You'll find that these crates are 2′ by 6′ by 6′. Stand them side by side with 2′ of space between them. As shown in the drawing, the top of one box makes the floor in the 2′ space. The top of the other box forms the ends of the roof, and the two inner walls make the roof and both doors—if you want a door at each end. Cut windows as desired. A four-light barn sash was used in the house pictured here. The roof is finished with composition shingles, and trim was cut from the box braces.—*Robert Culshaw, Pekin, Ill.*



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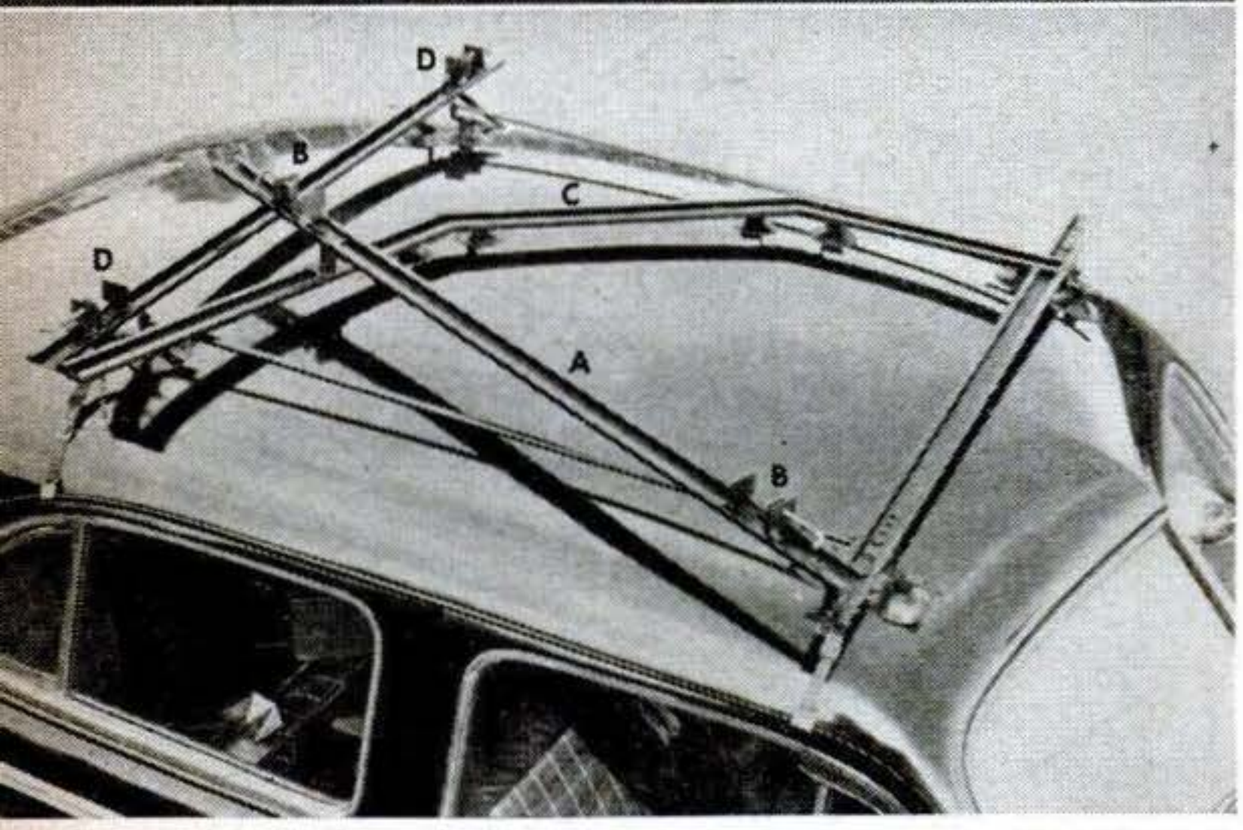


Carrier Eases Boat Loading

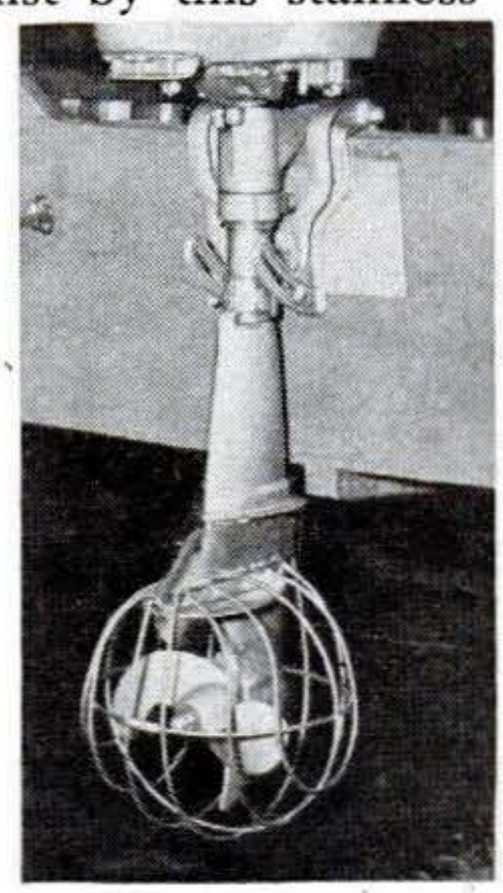
THIS carrier balances a small boat so that one man can lift it on or off a car top. Here's how it works: set bar A parallel to the side of the car, and lean boat against it, bow in air (top photo, above). Lock the gunwales in clamps B (lower photo, above). Next, lift the stern until the boat is horizontal. Bar A now rides in track C as the stern is swung around until bow points forward. Finally, clamp the aft gunwales at D. The rack is priced at $28.75 by Superior Sports Equipment, Inc., Lynn, Mass.

Bar Locks Motor Clamps

A NEW outboard accessory offered by Martin Motors, Eau Claire, Wis., is the Guard Lock®. It fits over the clamp knobs of the motor and securely locks the motor to the transom. The lock also may be used when the motor is on a rack in a boathouse.

Cage Guards Propeller

FOULED or bent propellers and sheared pins are guarded against by this stainless-steel cage that can be attached to any outboard motor. The maker, Luxurguard Manufacturing Co., Lockport, N. Y., says the cage protects propellers from submerged logs, rocks, shallow water, and underwater growths. It's especially recommended for outboards that leave the prop unprotected in reverse gear.



Pad Saves Paint Job and Cuts Vibration

A SHEET of the synthetic material shoemakers use for some half soles makes an excellent shock absorber and scuff pad for an outboard-powered boat. Shape it to match the motor bracket and 1″ larger all around. Cut a V where the bend will come to fit it over the top of the transom. Don't bring it too far down inside the transom or the clamps will catch and pull it off.—*Clinton R. Hull, Costa Mesa, Calif.*

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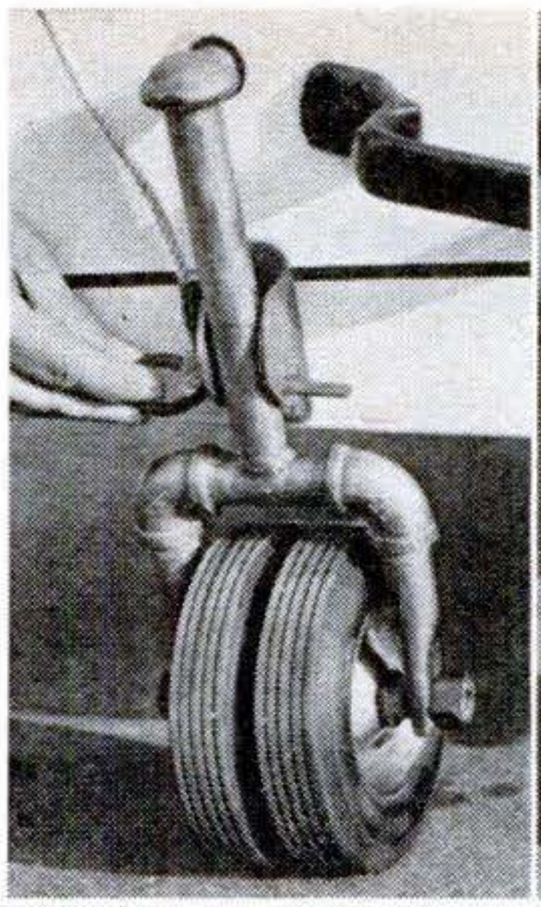

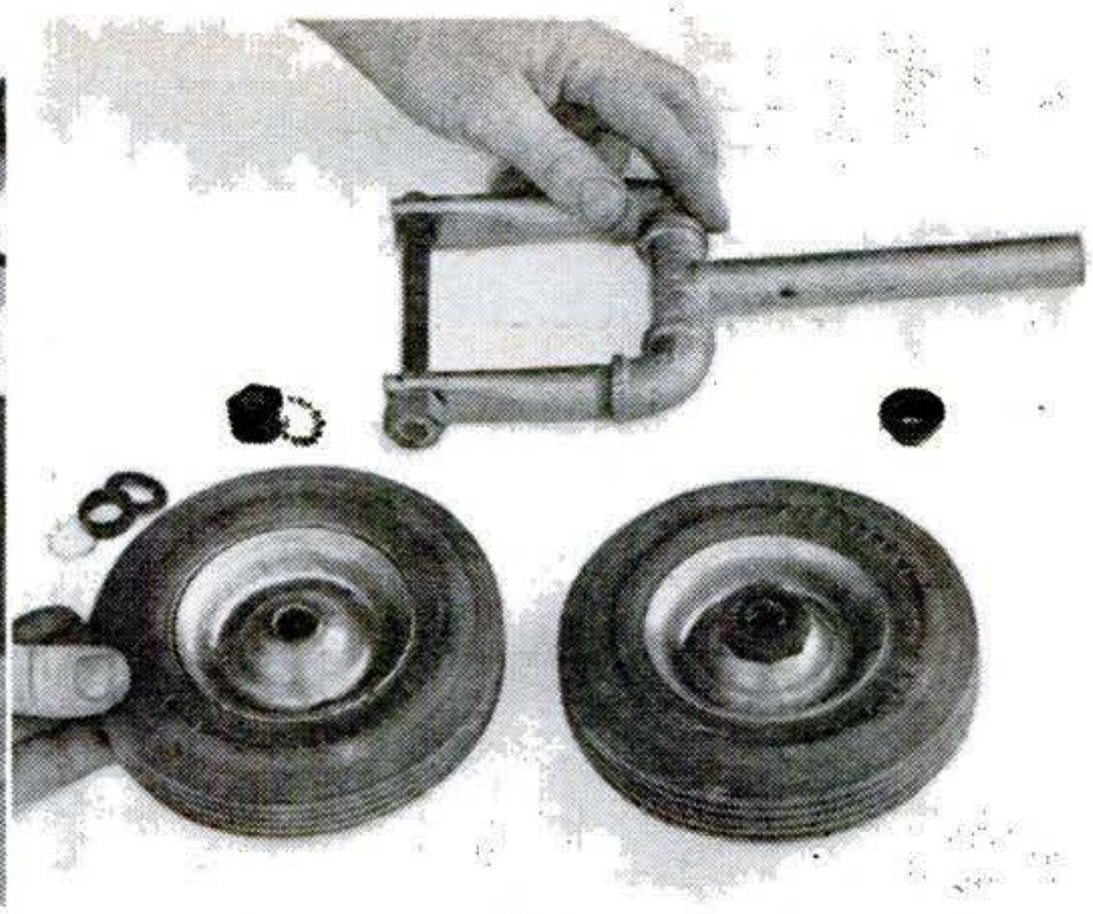

One set of wheels is shown in place in photo at left. After pin is pulled, fork slides easily out of bracket. Top of fork slips over shank of carriage bolt that's brazed in eye bolt through transom. Fork is ½" brass or galvanized-iron pipe. Wheel assembly is shown at right.

Detachable Wheels Aid Launching

GETTING outboard boats into and out of the water is a lot easier when detachable wheels are fitted at each side of the stern. For firm surfaces, a pair of single wheels will do. For sand and soft dirt, duals are better. Once the boat is afloat, the wheels can be taken in easily over the transom.

Use small semipneumatic wheels with bronze bearings; ball-bearing wheels won't take immersion and grit. The wheel disks are steel and must be kept painted.

The fork assembly is ½" brass pipe. Galvanized pipe will do, but isn't as desirable. The length of the nipple (including threads) between the elbows is ½" greater than the width of the wheels. The arms of the fork are flattened at one end for the axle and threaded at the other for the elbows. These arms are 1½" longer than the distance from the center of the hub to the tread of the tires. The stem is unthreaded. One end is filed out to fit the nipple for a stronger brazed joint. Holes for the axle bolt are drilled ¾" from the flattened end of the arms.

A thick felt washer between the hubs of the dual wheels exerts firm pressure on two fiber washers. Metal spacers and two more fiber washers between the outer hubs and arms keep out sand and mud. Smear the axles liberally with the kind of grease used in the lower unit of outboard motors.

The U-shaped brackets screwed to the transom are 3/16" by 1¼" brass. Drill ¼" holes through the tips of these brackets and through the stem to take a ¼" eye pin. The top carrier assembly is a ⅜" eye bolt through the transom with a short carriage bolt brazed in the eye. The top of the stem slips around the shank of this bolt and carries the weight.—*Clinton R. Hull, Costa Mesa, Calif.*

Jacket Has Built-in Life Preserver

DESIGNED for boatmen, this sport jacket has an inflatable Vinylite® life preserver built into it. Uninflated, the garment appears to be a conventional sport jacket. In an emergency, the hidden preserver is inflated by mouth. When it has been blown up, the air is retained by twisting the valve cap. The preserver extends around the chest and neck, as shown in the photo at right. It's made in sizes for men, women, and children by Neptune Specialties, Inc., of Brooklyn, N. Y., and priced at $28.

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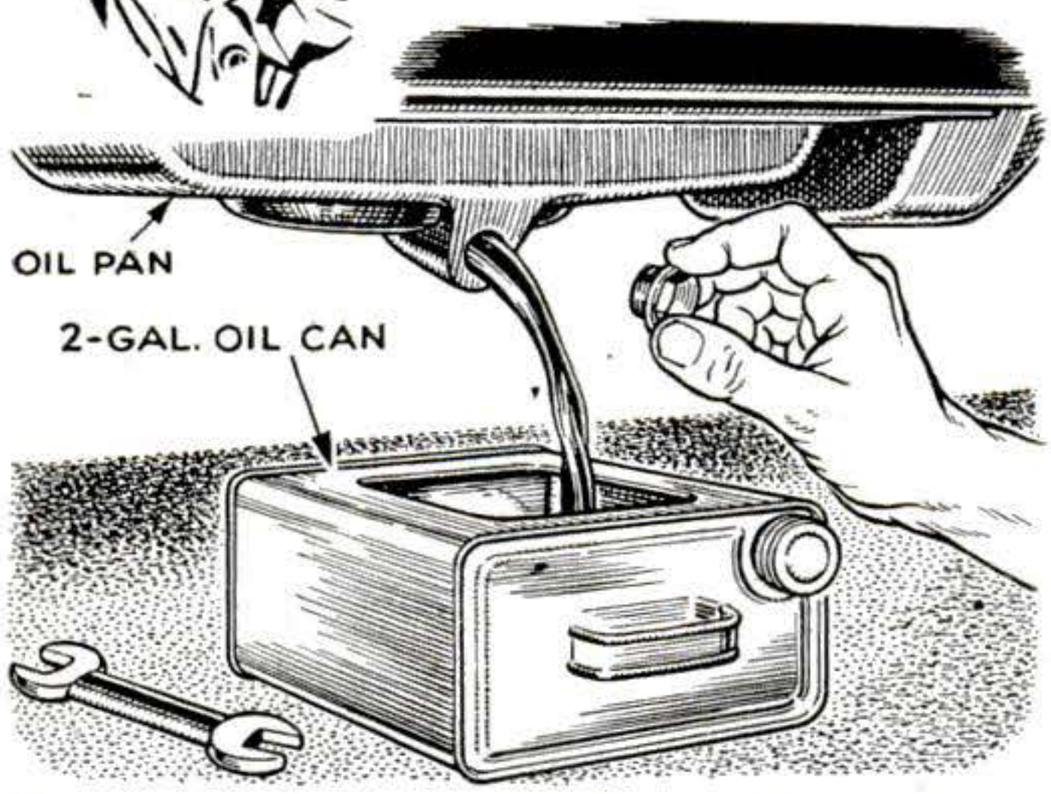
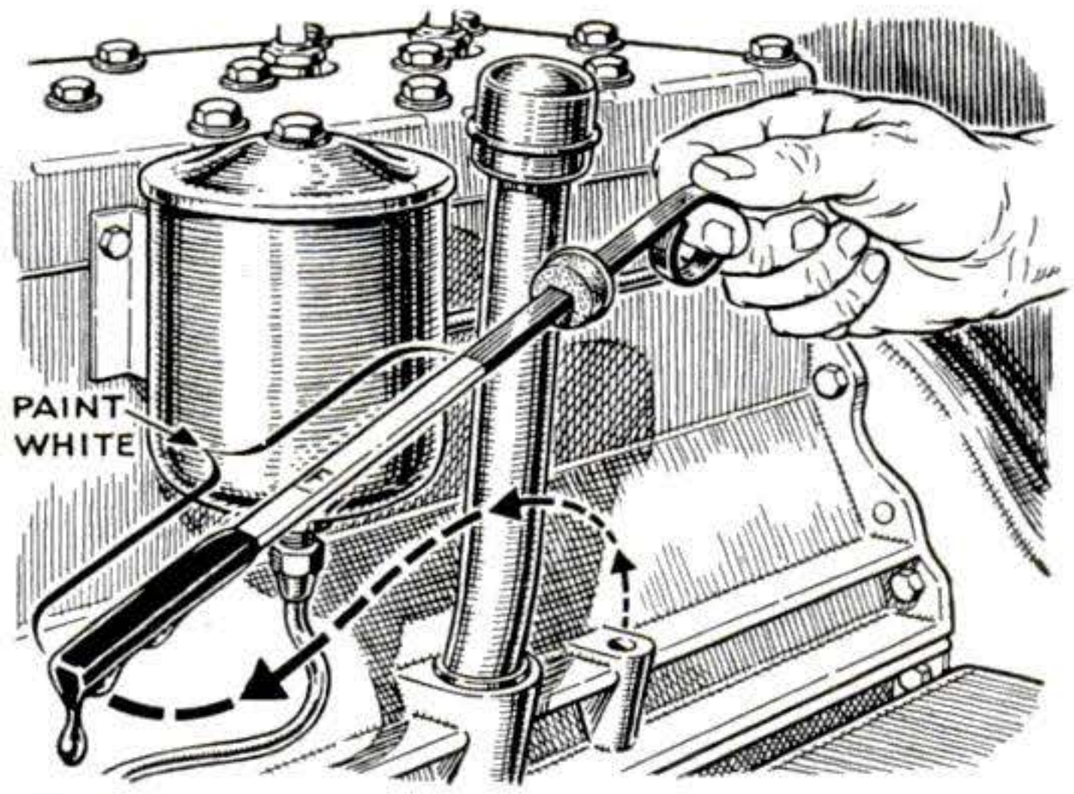
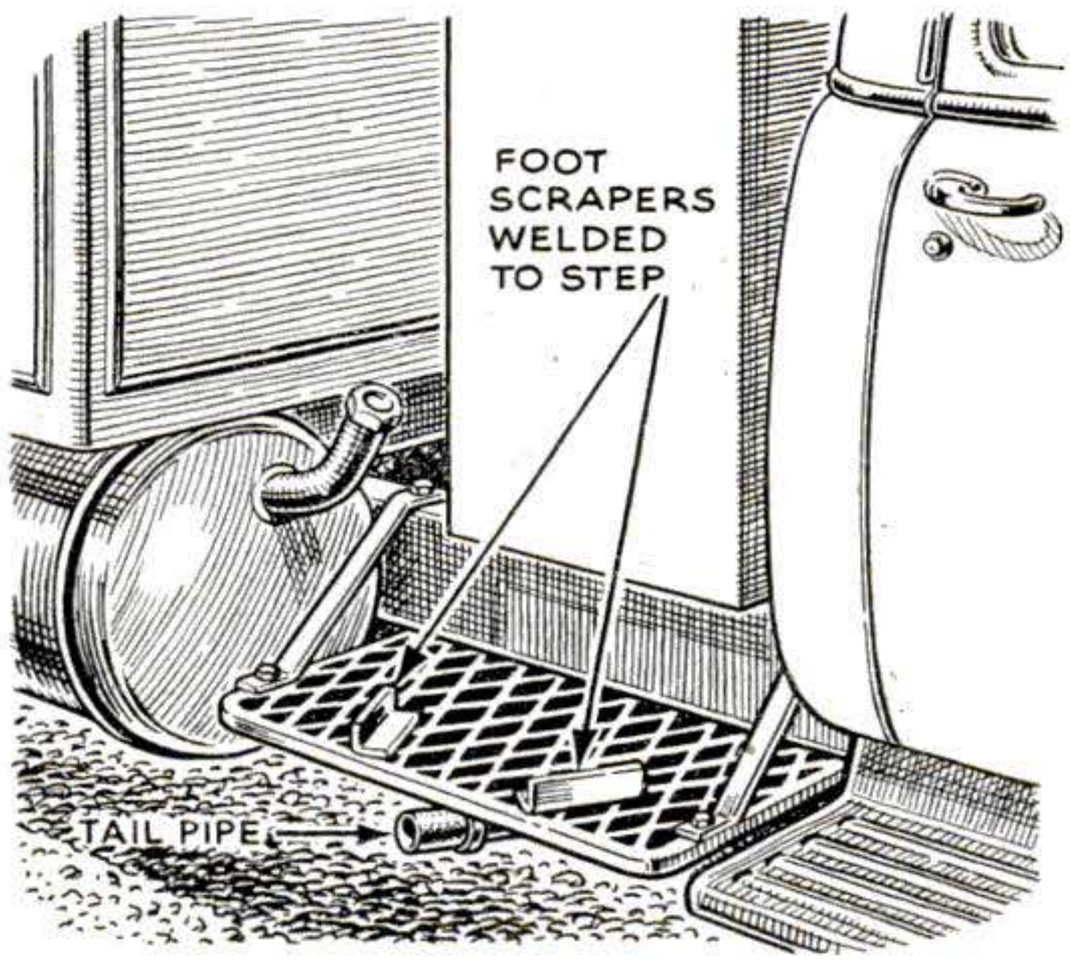
Hints from the Model Garage



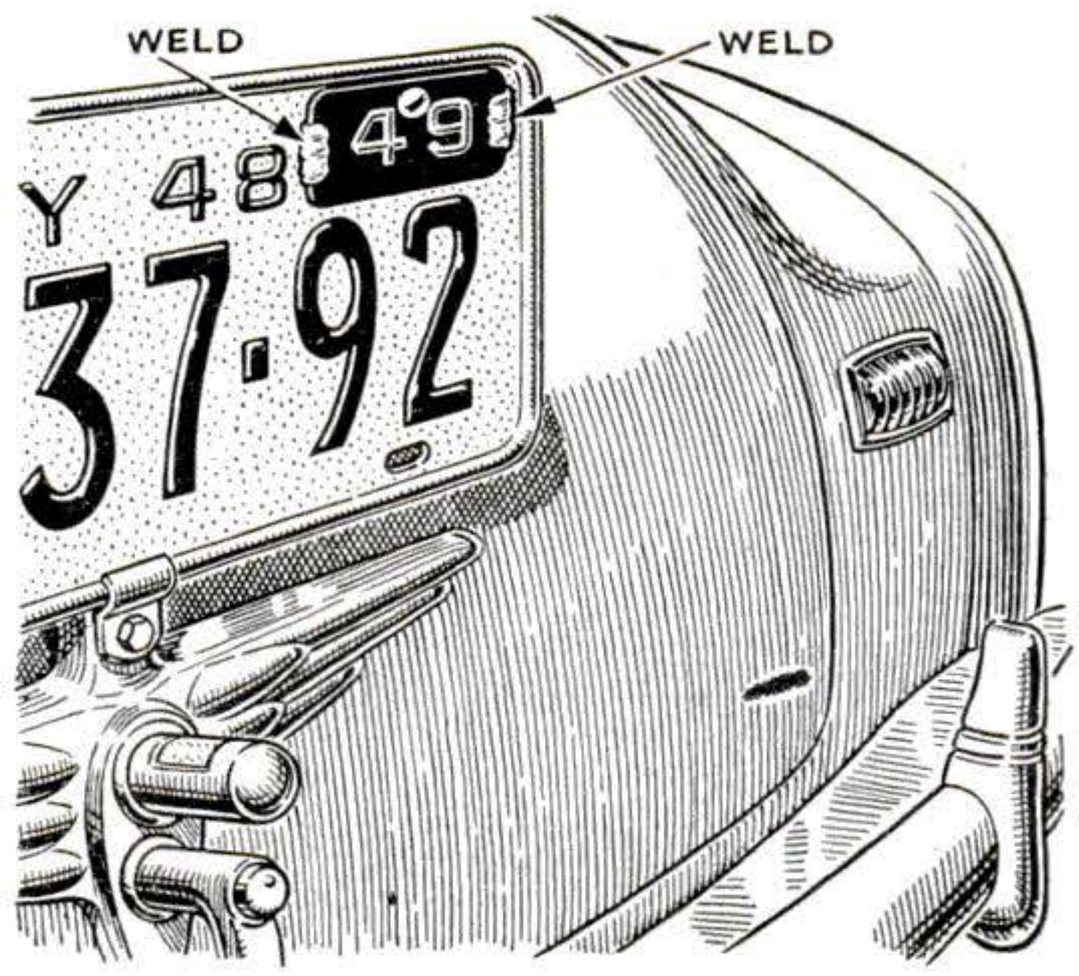
Oil Drained into Flat Can. Some new cars are so low that it's awkward to drain the crankcase without a lift. The job calls for a shallow but capacious pan. Victor H. Lamoy, of Upper Jay, N. Y., reports that an empty 2-gal. oil can with a large opening cut in one side gets under easily. Leave a lip around the hole to keep the oil from slopping when you drag out the filled can.



White Stick Shows Oil Level. It's always a little difficult to be sure of the oil level on a dark dip stick. M. M. Dierks, of Chicago, says a coating of white lacquer has taken care of the problem in his case. Before applying the lacquer, he scoured off all traces of oil from the stick and then cleaned it thoroughly with a wire scratch wheel to give good adhesion.



Foot Scraper Aids Safety. Wet mud is as dangerous on the step and floor of a truck cab as slippery ice. Operators of one Texas truck fleet welded foot scrapers on auxiliary steps just behind the regular ones to enable drivers to clean their shoes as they enter. To keep the step clear in winter, the exhaust line is piped underneath.



Welding Prevents Loss. To save metal, several states have adopted the practice of issuing small year tags for renewal of old license plates. To prevent loss or theft, you can tack-weld them to the plate. If carefully done, low-heat arc welding will not distort the metal nor burn more than a small, easily retouched area of paint.

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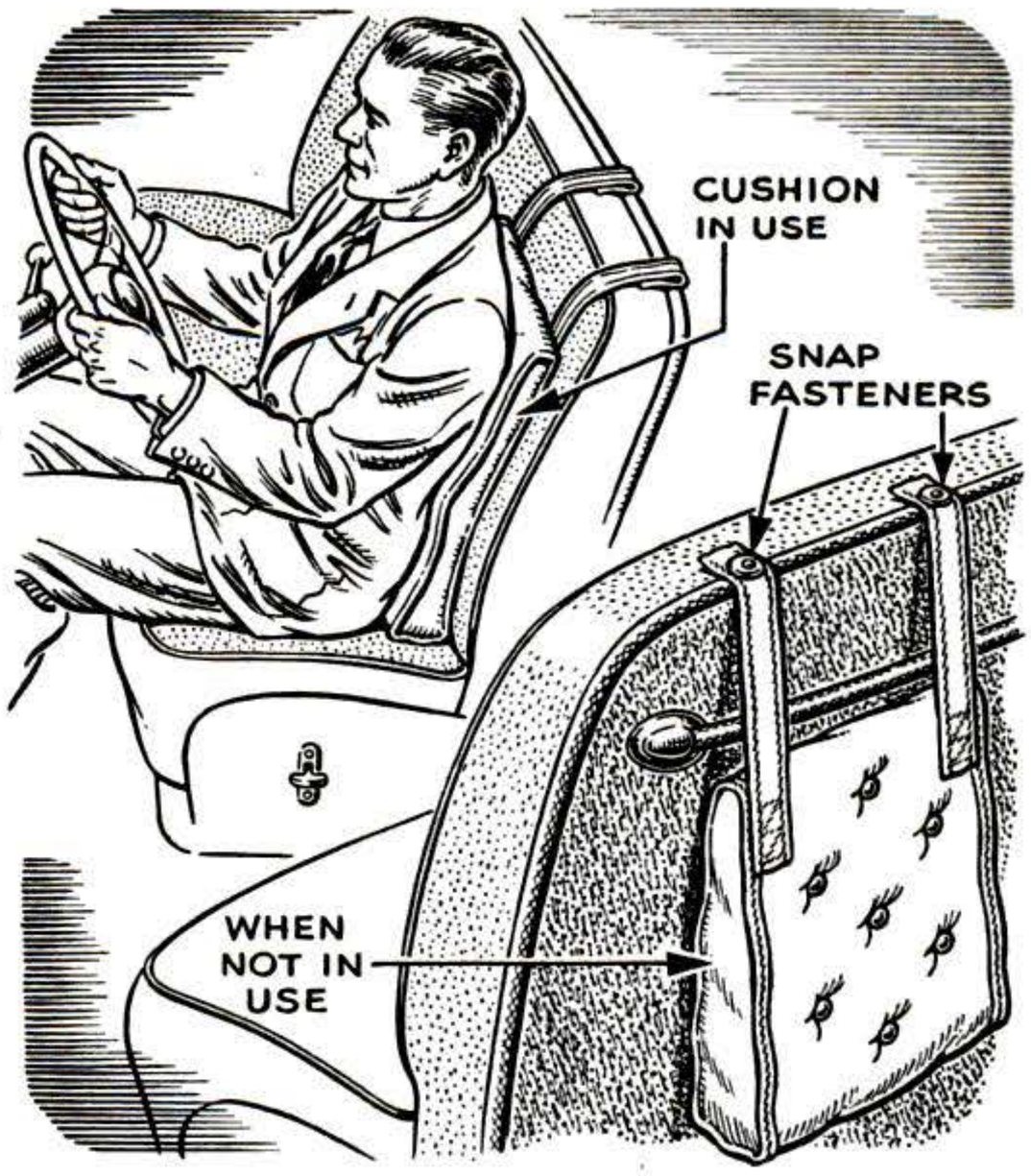
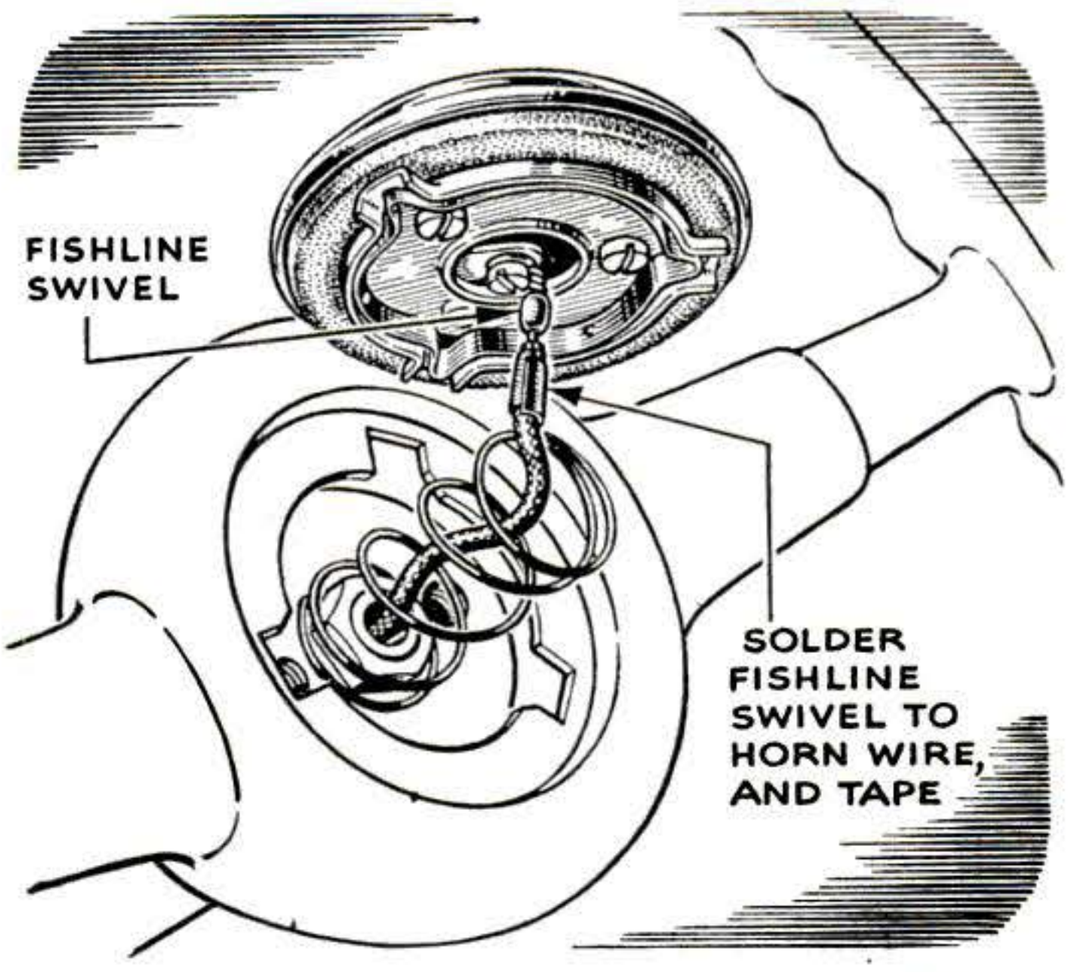
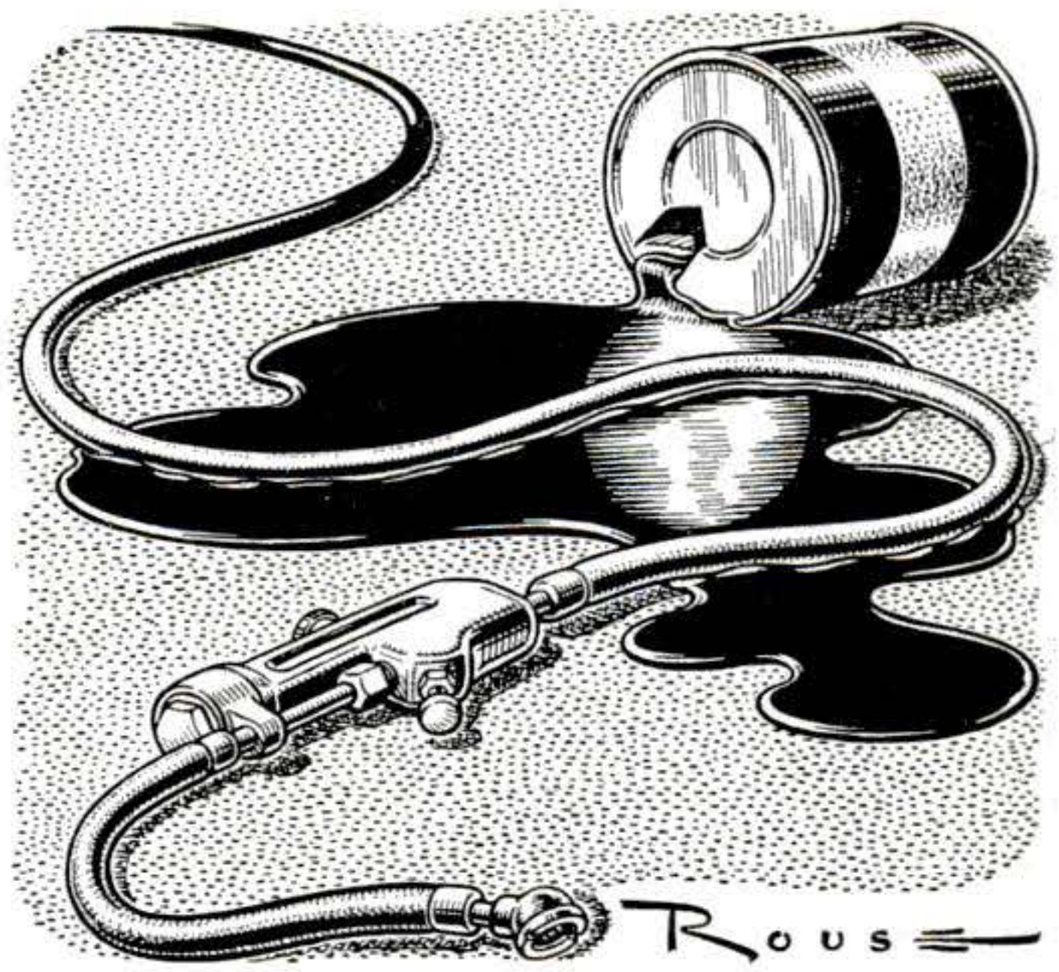
Handkerchief Tags Car. When you must park in a lot where there are hundreds of cars, as at the beach, ball park, or fair grounds, you can make it easier to find your car by extending the radio aerial to its full height. First tie a handkerchief or piece of tissue paper to its tip.



Back Rest Flips Out of Way. Does your wife need a cushion behind her to reach the pedals easily? Here's an excellent method of having the cushion always available but still out of the way when not needed. You may also find it handy yourself for changing your position on long drives.



Swivel Safeguards Horn Wire. In some cars the horn wire inside the steering column is subjected to considerable twisting. C. B. Hopkins, of Tacoma, Wash., found that this caused the wire on his 1941 Ford to break several times. A brass fishline swivel, taped as shown above, took care of the problem nicely.



Oil Rots Rubber. If you run a shop, you know the cost of air hoses, battery-charger cables, and other rubber equipment. One sure way of increasing this cost is illustrated here. Grease and oil cause rubber to disintegrate rapidly. So keep such equipment off the floor. It's also a good idea to wipe off the lines occasionally.

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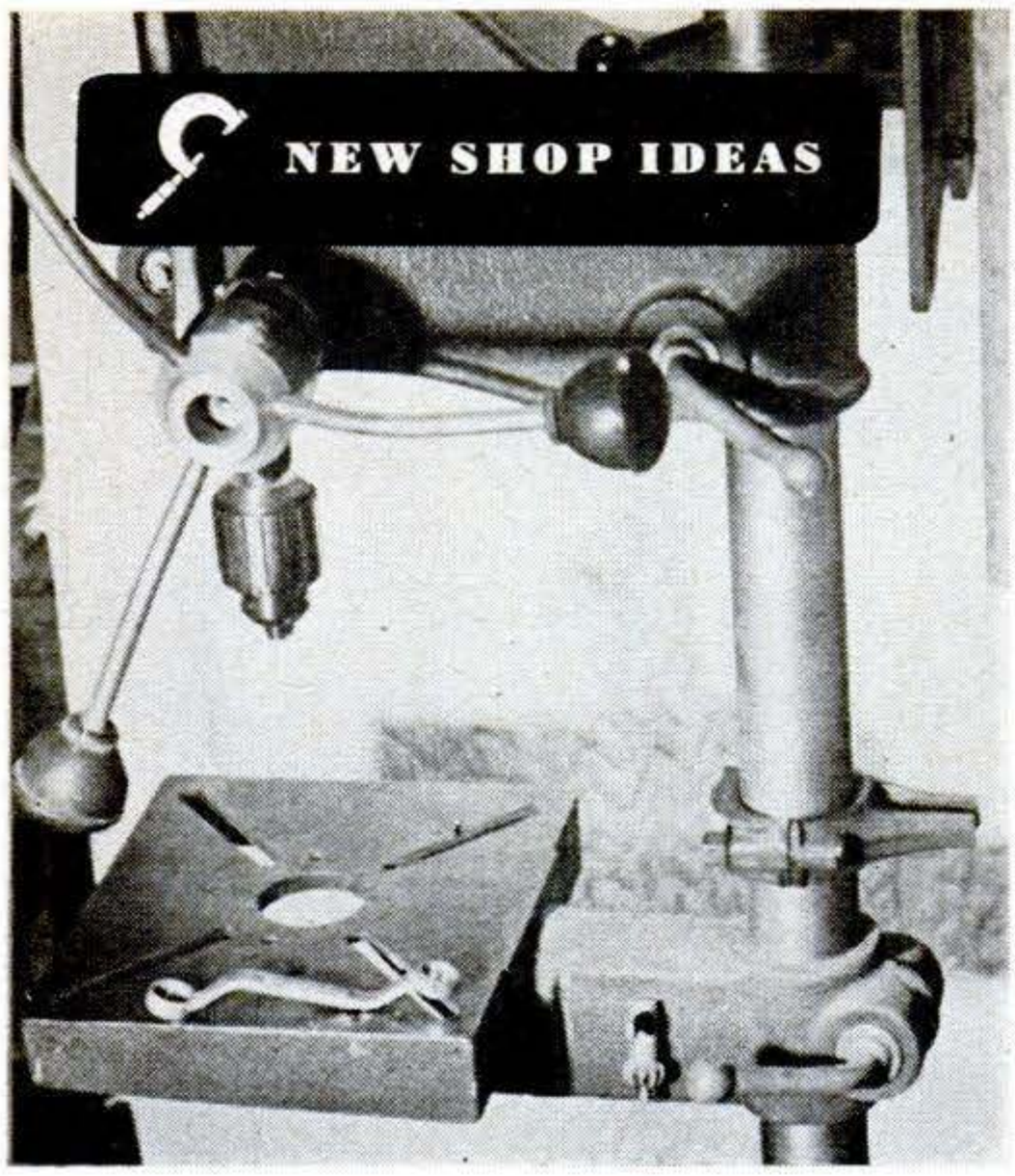
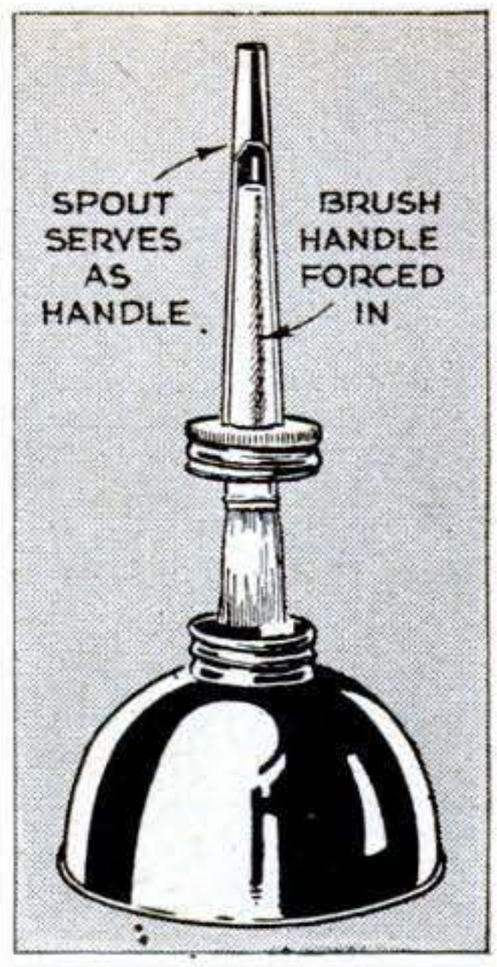


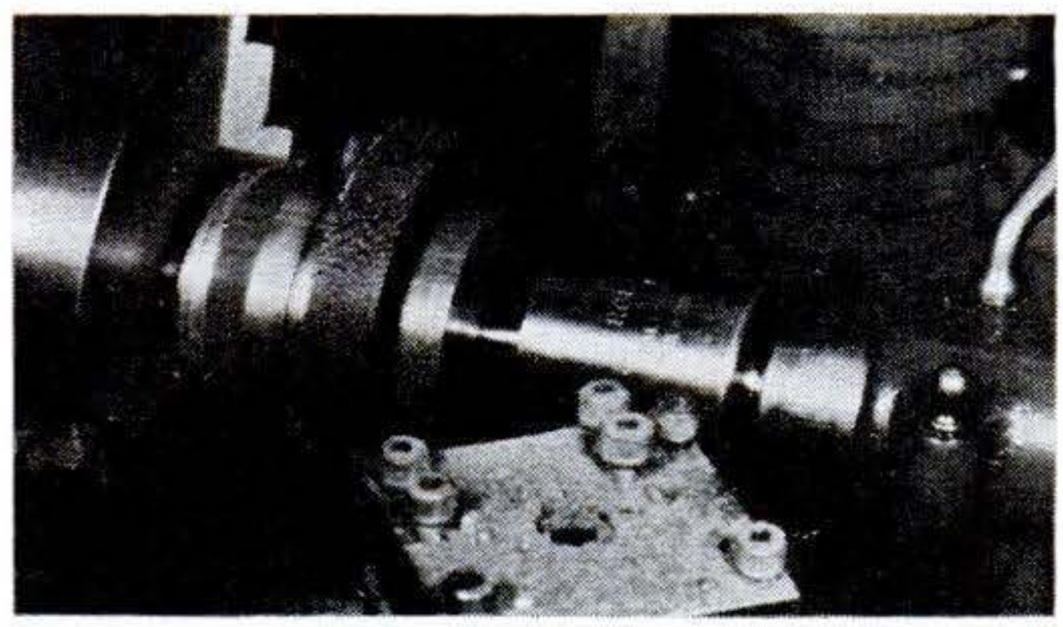
Collar Made from Con Rod. The collar found on some drill-press columns is a handy accessory. If there's none on your press, the crankshaft end of a connecting rod makes an excellent substitute.

Con rods are available in many sizes. If necessary, the babbitt can be removed to give a larger inner diameter. Take off the bearing cap and file the flat surfaces until the clamp locks on the column securely. Leave part of the shank as a handle.

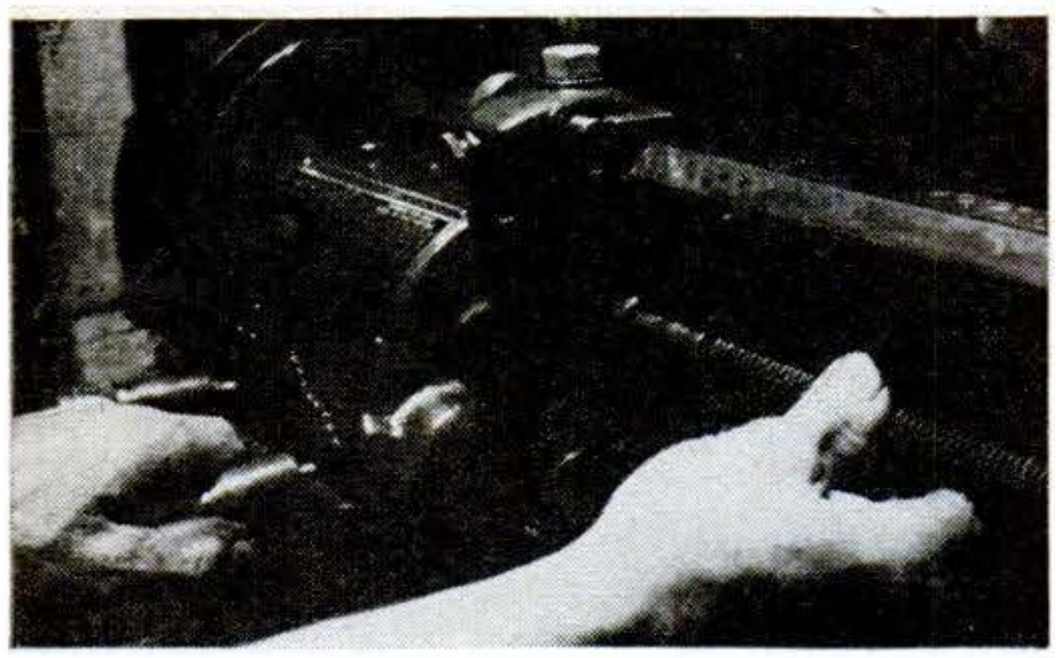
The collar does the work of an extra hand by supporting the heavy drill head temporarily while you are adjusting it.—*E. I. Hockaday, Jefferson City, Mo.*

Oil Can Holds Layout Dope. A convenient container for layout dope, used by machinists and tool makers, is easily made from an oil can and small paint brush with a round handle. Saw off the tip of the spout. Sand the brush handle and jam it into the spout until the brush tip rests ¼" above the bottom of the can.

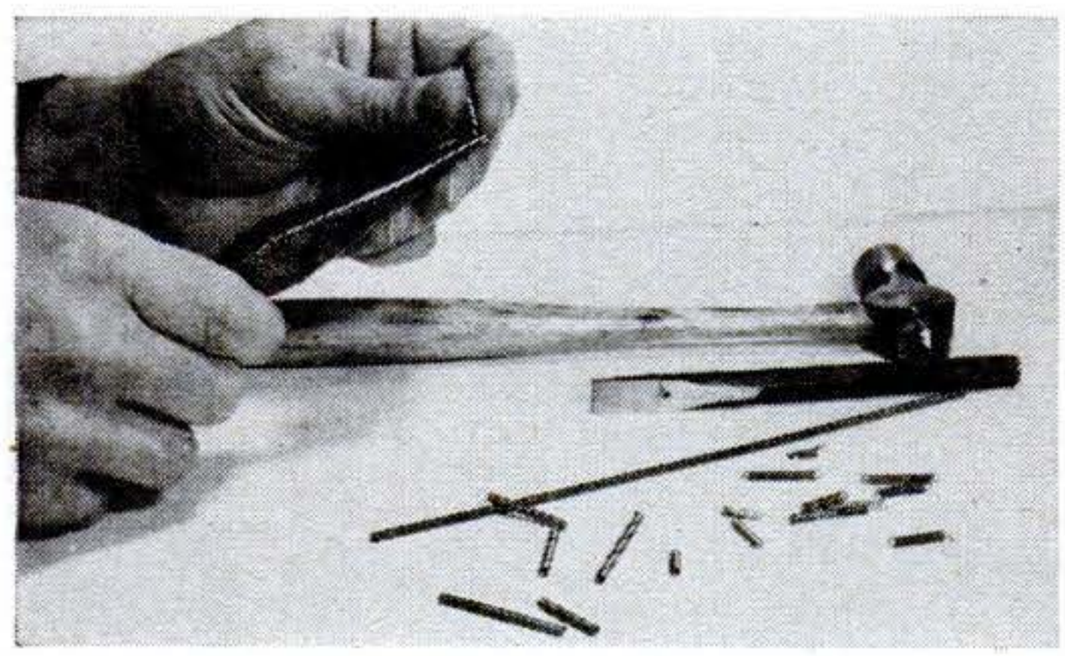




Turning Solid Blanks. With a ball-bearing center and adapter plate, you can easily turn the outside of solid disks or blanks. Face the adapter parallel and drill a 60° center hole. Clamp the work between the adapter and a piece of trued stock held in the three-jaw chuck. Center the blank by tapping with a mallet.



Wobbling Meshes Lathe Gears. To set the quick-change gear levers on your lathe more easily, turn the lead screw back and forth about a quarter turn with one hand while engaging the lever with the other. The "wobbling" helps to mesh the gears. When using this kink, set the fine-range lever first.—*Heinz Landauer, Tampa, Fla.*



Springs from Movie Belting. If you need small coil springs, a camera shop is a good source of supply. Buy a replacement belt for a movie projector and cut with a chisel into springs of the desired length. Form hooks with long-nose pliers. Stretch the stock first if you want to make compression springs.

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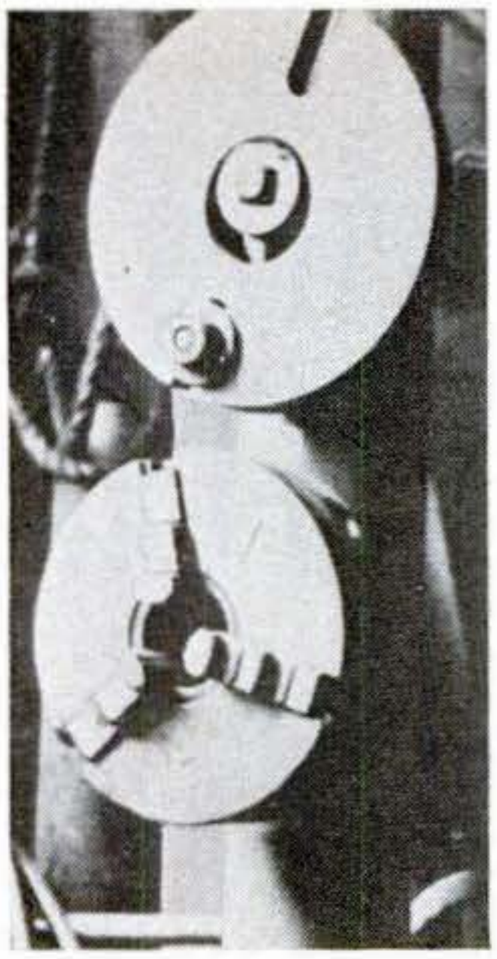
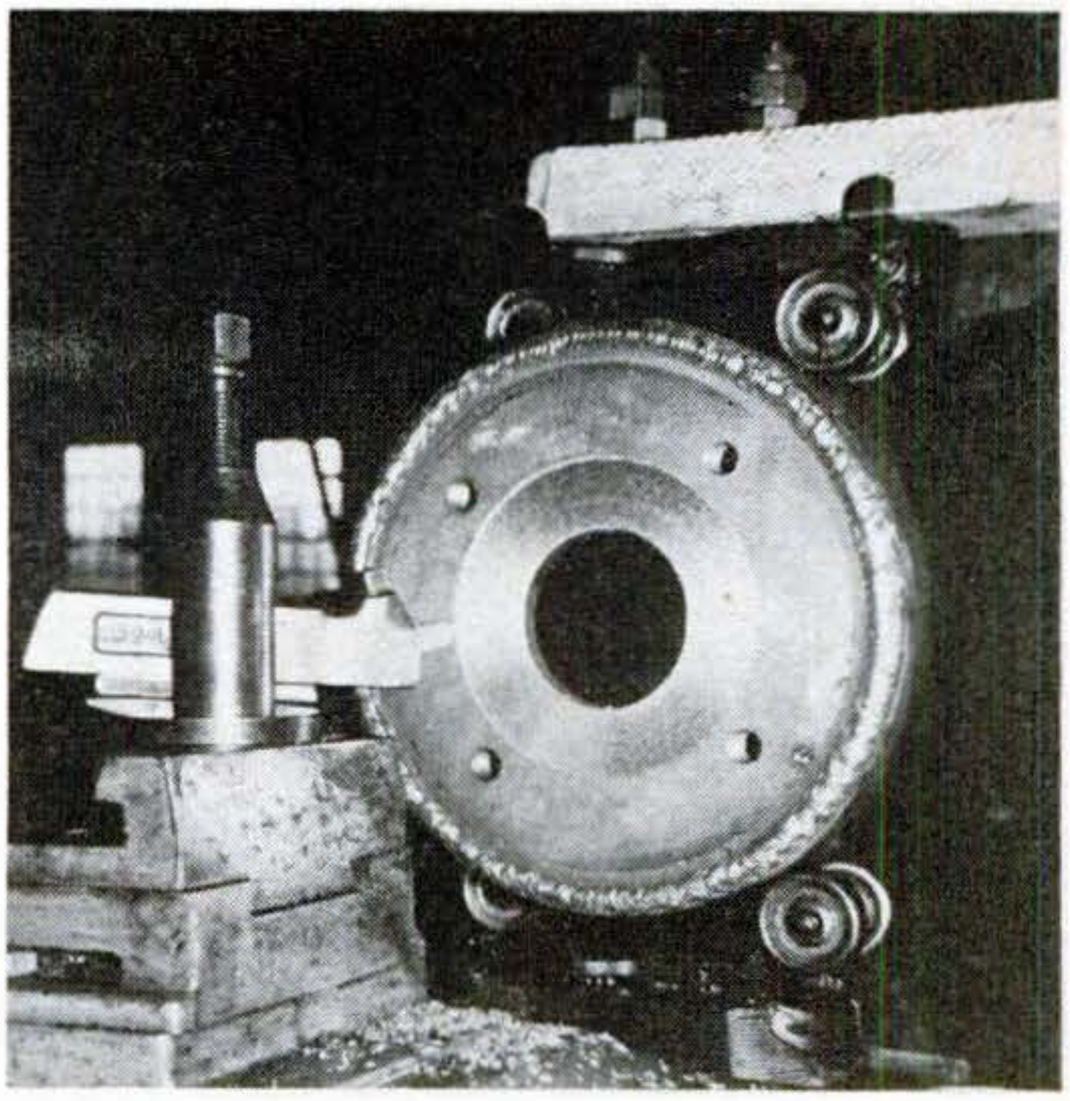
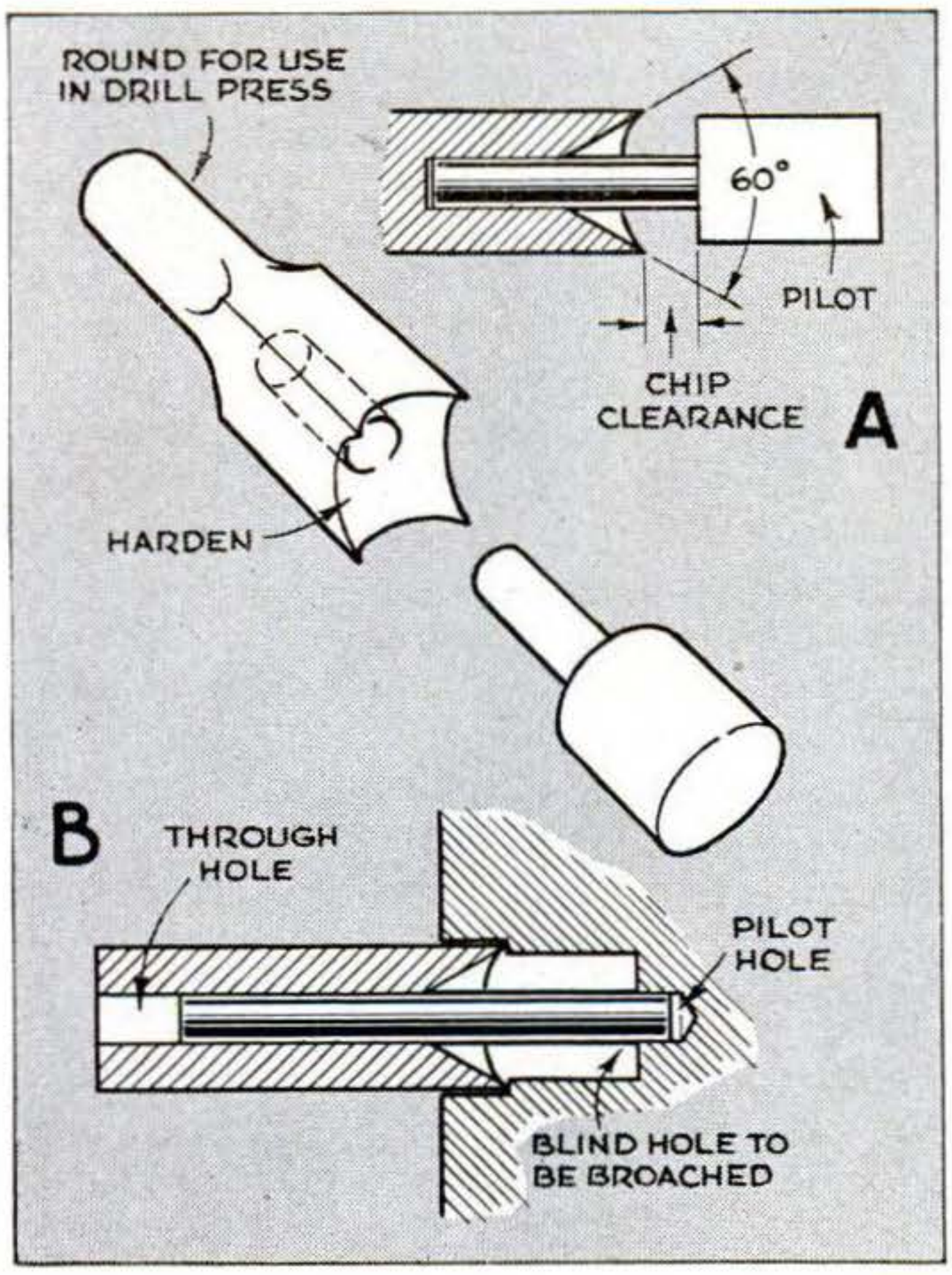


Soft Pins Protect Tools. It's not advisable to hang up a lathe chuck or faceplate on nails. The threads that take the spindle nose may be damaged. A better idea is to cut rings or cylinders from soft material such as composition board and attach them to a shop wall or a post.—*J. C. Albright, Santa Monica, Calif.*



Big Work Rolls on Skates. Some steel tubing rolls had to be faced off in a hurry, but our steady rest wasn't big enough. Here's how we did the job.

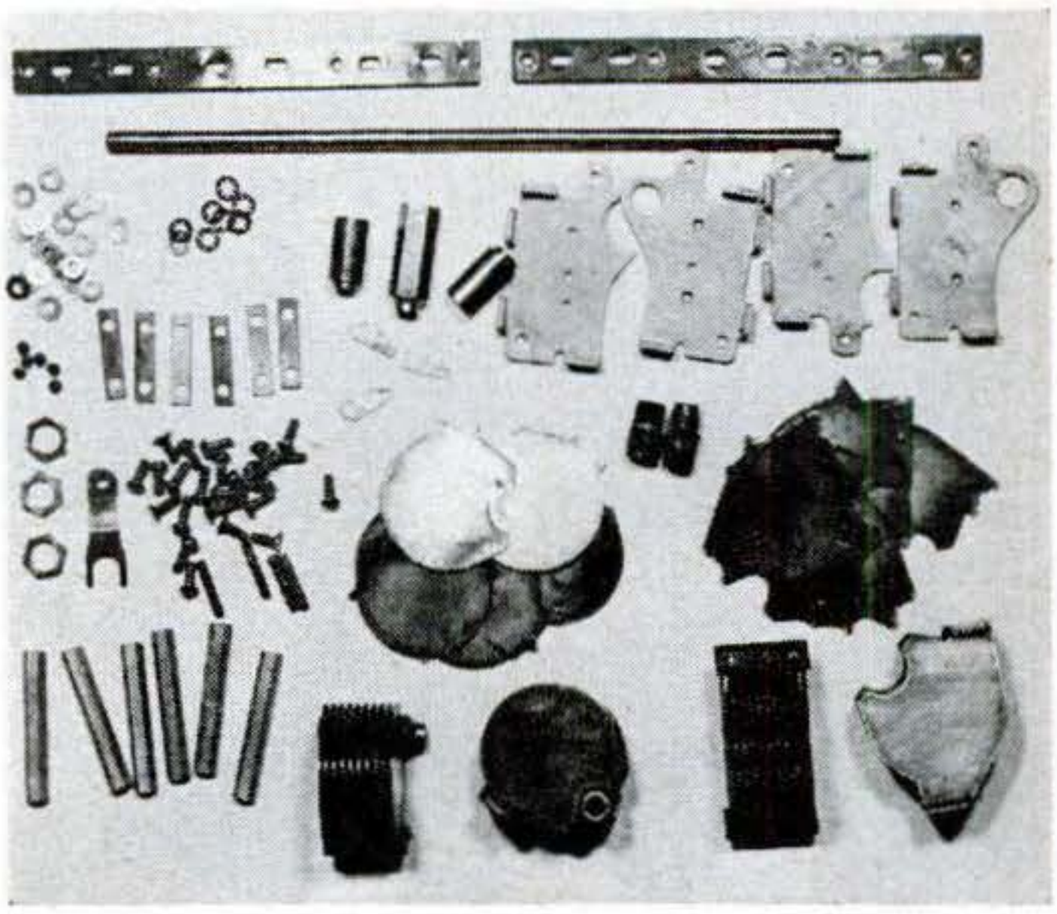
One roller skate, shimmed to the proper height, was clamped to the lathe ways. Another was bolted to a two-by-four above the tubing. The two-by-four was anchored at the outer end and weighted near the work. —*Henry J. Denomme, Lowell, Mass.*



Broach Cuts Square Holes. For soft metal, you can chuck this square-hole broach in a drill press. However, it will generally be better to use an arbor press or a bench vise and hammer.

Chuck the blank in a lathe to turn down the shank and drill the pilot hole. You might file the bit, but you'll probably find it easier to do on the lathe with a round-nosed tool and the compound feed.

For through holes, turn a round pilot (A) to guide the broach. For blind holes (B), drill a pilot hole at the bottom and use a guide that can be withdrawn through the broach body.—*D. Bisceglia, Troy, N. Y.*



Condenser Parts Salvaged. In need of a short length of ¼" steel rod, I remembered an old radio stored away in the attic. The three-gang tuning condenser not only supplied the desired rod, but many other useful items as well.

Included in the parts, shown above, are two dozen 6-32 brass machine screws, six 8-32 setscrews, two dozen special washers, eight lock washers, and numerous brass plates.—*A. C. Porter, South Bend, Ind.*

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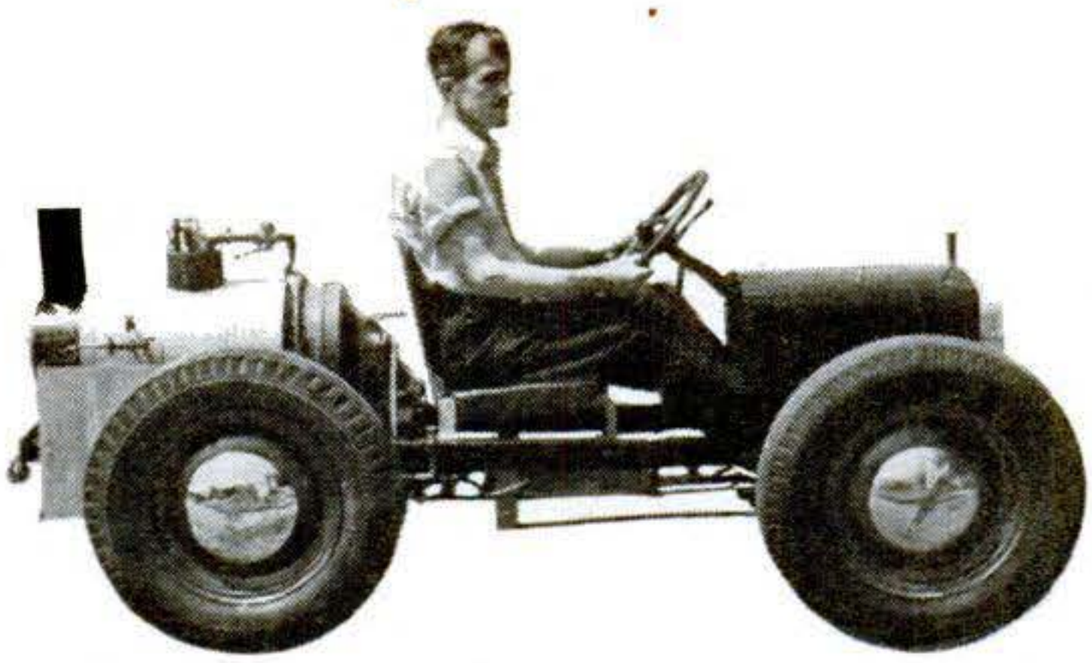
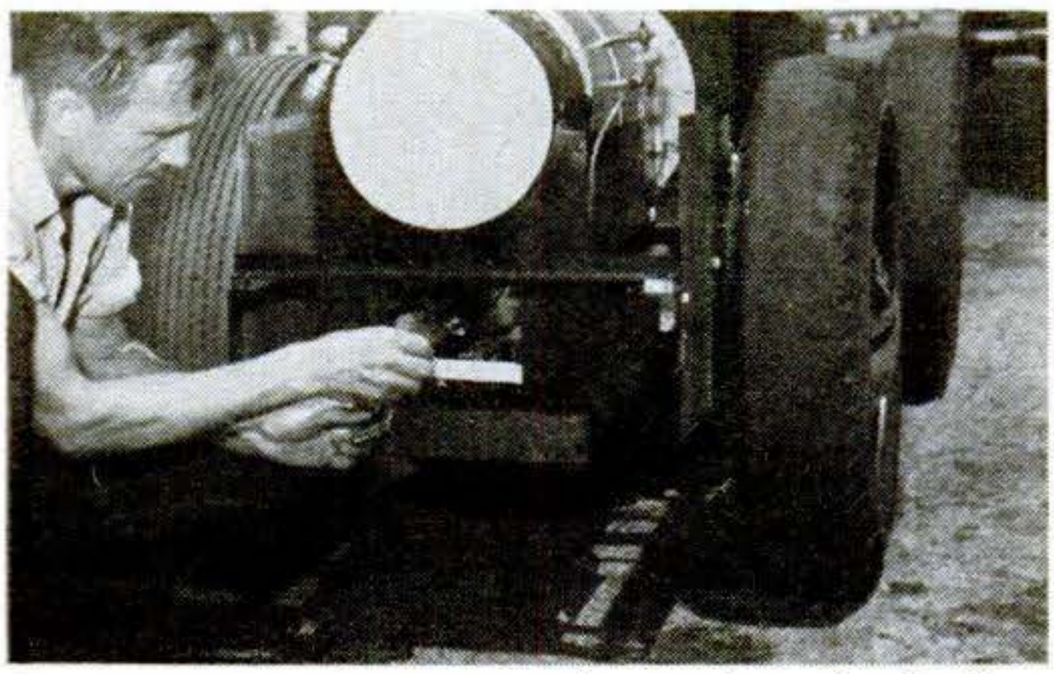
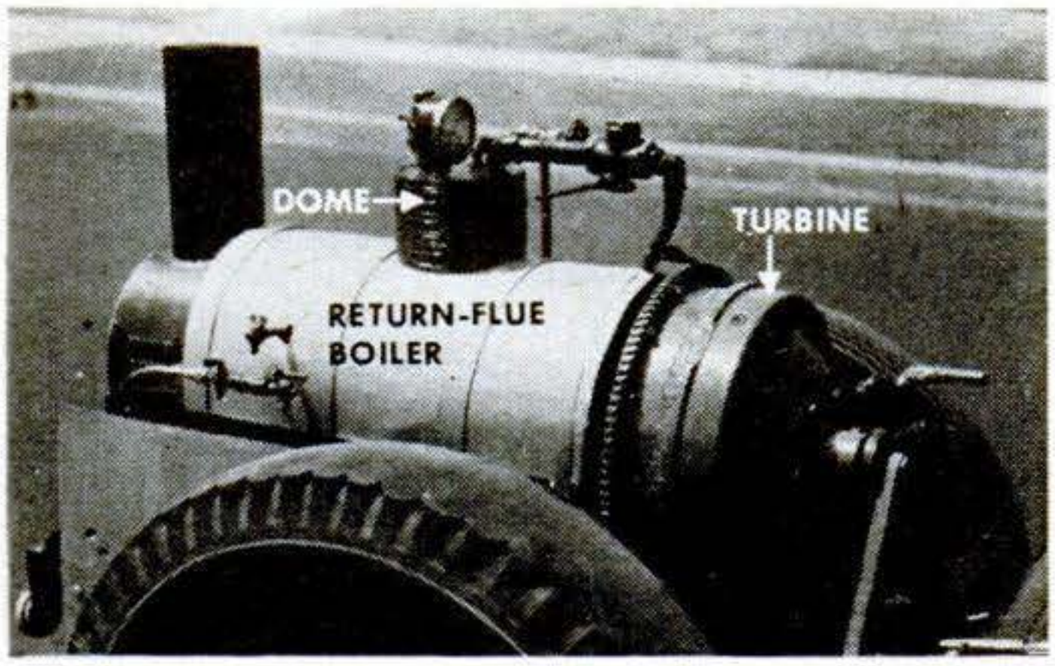


Little steamer has cut-down Model T chassis, Dodge wheels, and a Locomobile jump seat. It runs smoothly and quietly—but not very fast.



Scraps of hardwood are burned in the firebox at present time, but designer plans to install oil burner. Boiler gets up steam in 20 min.



Steam gauge atop the dome shows when car is ready to roll. For superheating, 12′ of ⅜″ copper tubing is coiled inside firebox.

Turbine Drives Small Steam Car

WHEN its whistle toots, you needn't jump too quickly to get out of the way of this little steam car. Its top speed, on the level, is just a shade over 8 m.p.h.

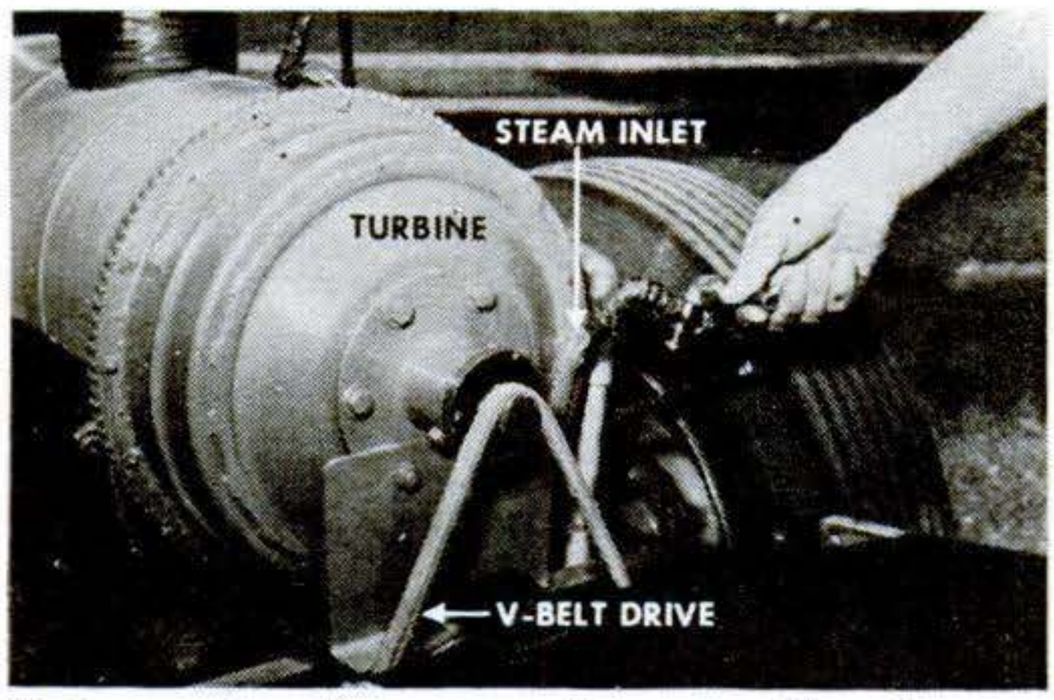
J. E. Mitchener, of Los Angeles, built it strictly as an experiment, putting to use some of the notions stored up during his experience as an auto and railway mechanic.

Power comes from a turbine set behind the driver's seat. The turbine consists of two rows of buckets on an 8″ flywheel mounted on ball bearings. A Packard brake drum, widened to 4″, encloses the unit.

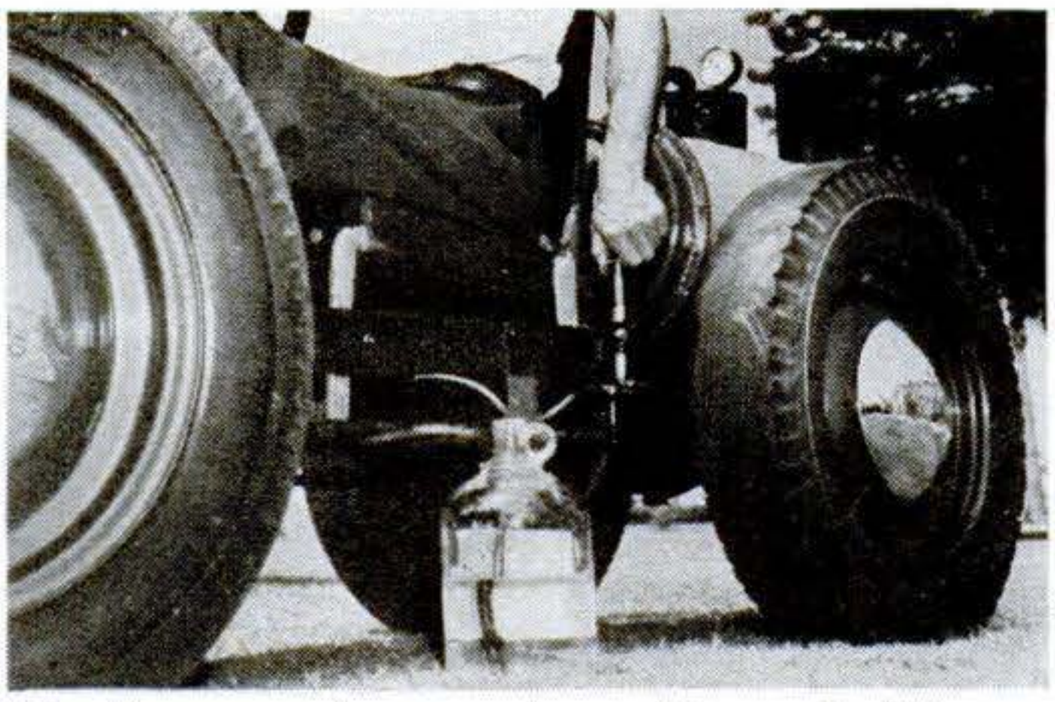
Hardwood scraps fire the boiler, which is the return tubular type with two water coils in the firebox. Steam passes from the dome through a superheater before reaching the turbine. A section of oil-well casing serves as the boiler shell. Operating steam pressure is 150 lb.

To give a better draft, the exhaust jets out the stack, as in a locomotive. The stack is a 4″ Diesel exhaust pipe.

The machine cost its builder $25 and some 500 hours of work over a year's time. For the chassis, a Model T Ford was cut down to 58″ wheelbase and 29″ tread. A belt drive transmits power from the turbine to a Model T rear end. All-over ratio from turbine to wheels is about 40 to 1.



Belt carries the power from small pulley on turbine to a large one on the rear-end unit below. Ratio between pulleys is about 10 to 1.



Hand-operated pump is used to replenish water in boiler at frequent intervals. Boiler operates 35 minutes on a single 5-gal. filling.

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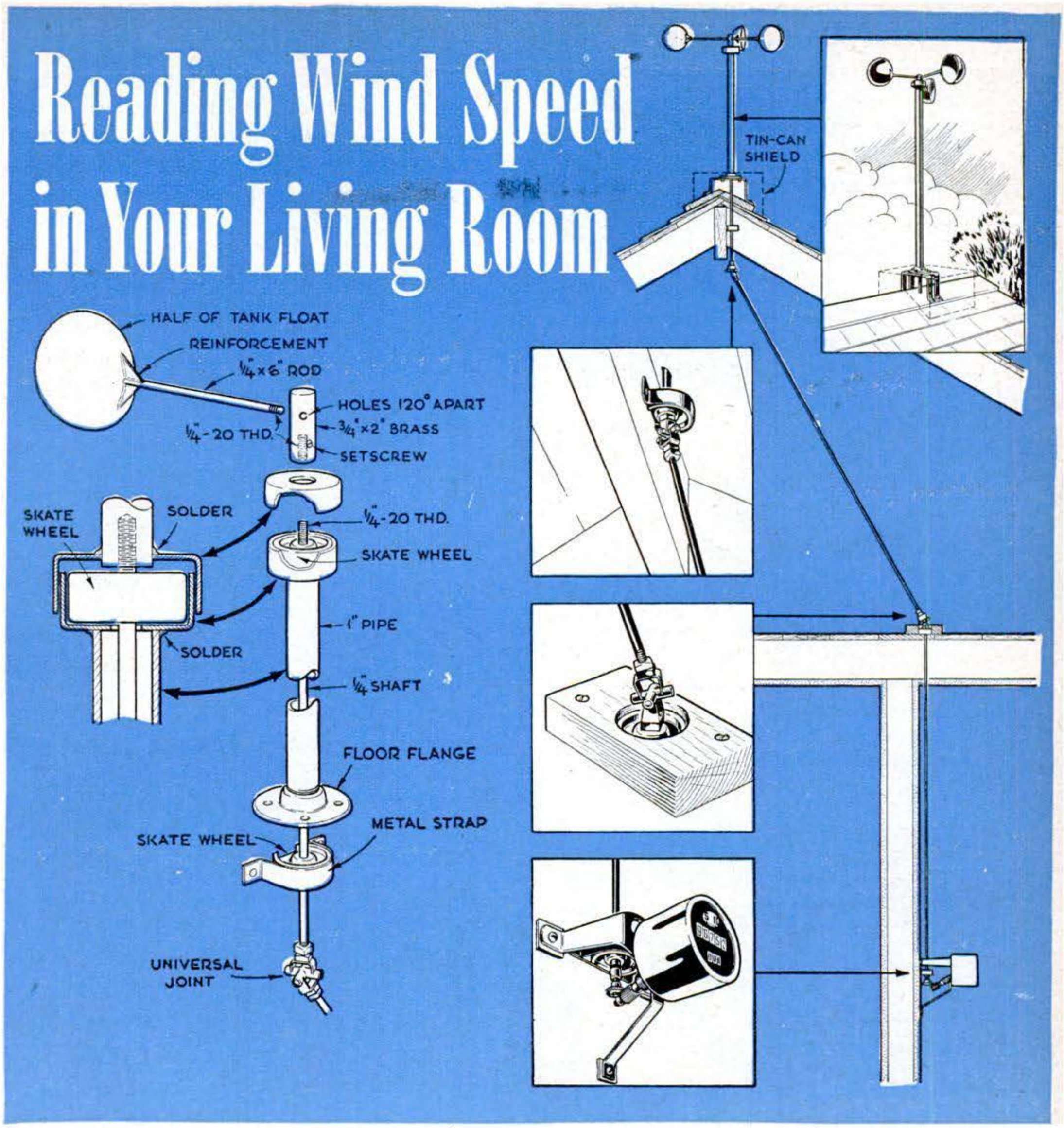
Reading Wind Speed in Your Living Room



IF YOU fly, sail, or just like to know what the weather is doing, you may want to take a cue from Keith Rumsey, of Friendship, N. Y. Parlaying an old speedometer, skate wheels, pipe, and other odd parts into a wind-speed indicator, he won a prize in a PS contest for ingenious uses of old auto instruments. The gadget has reported velocities as high as 62 m.p.h.

The anemometer cups were made by filing apart copper water-closet tank floats, and the rotating cup assembly was carefully balanced with solder. At the lower shaft end, a crown and a pinion gear with the same tooth count give direct readings. The instrument was mounted on a truck and its readings tested by comparison with the vehicle's speedometer on a calm day.

It's important, Rumsey reports, to remove the internal shaft that drives the trip and mileage dials, to reduce friction. He mounted the speedometer on rubber to damp out noise (you could fit a pin or brake to lock the shaft when readings aren't wanted). Putting the instrument upstairs in a two-story house would avoid running a shaft through the rooms, and cut down on the drive load.

Mount the cups at least 2 feet above the ridgepole (more if possible) and away from chimneys and trees. Keep bearings and speedometer well oiled. If the shaft angles are very small, light rubber tubing can be used instead of universal joints.

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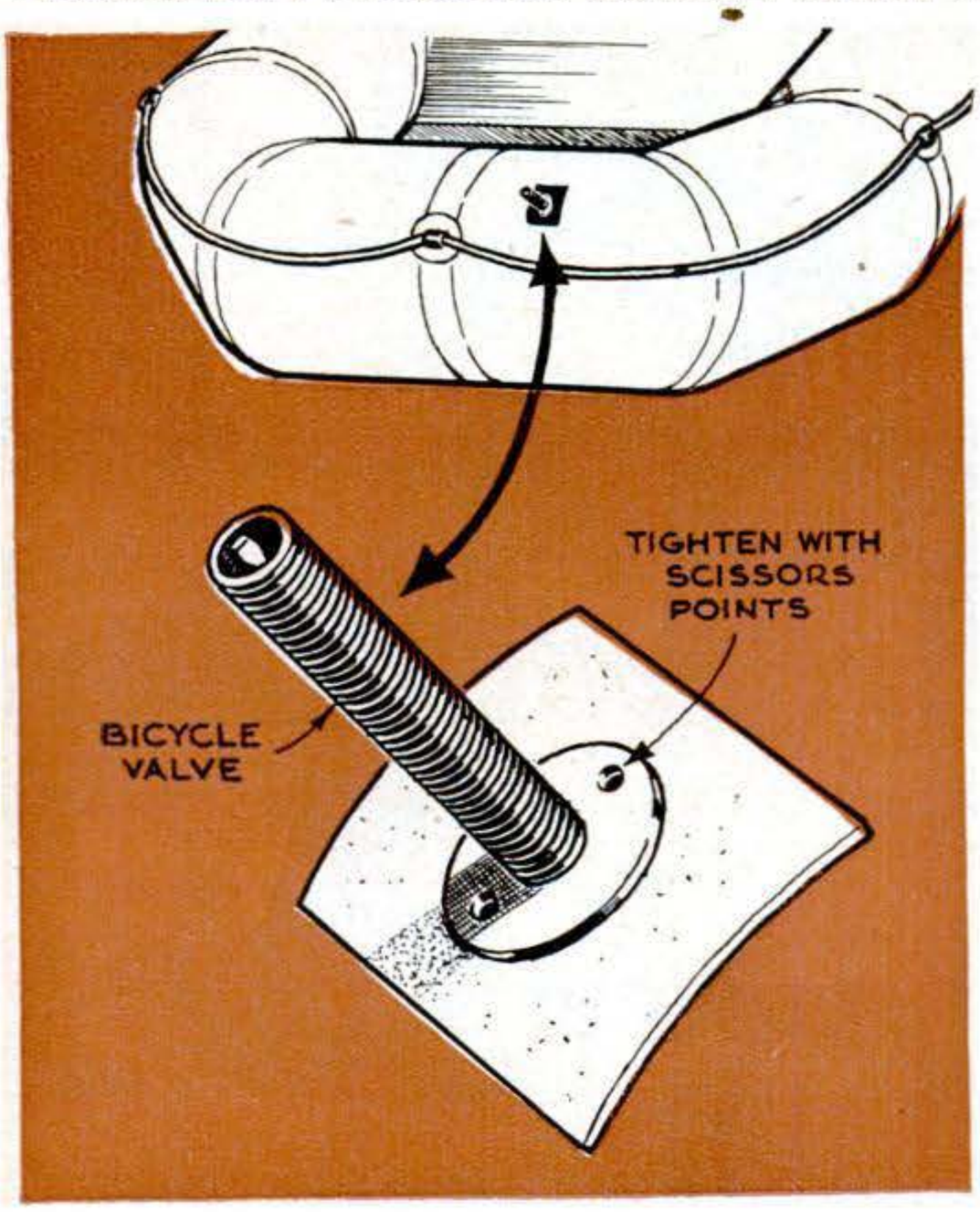
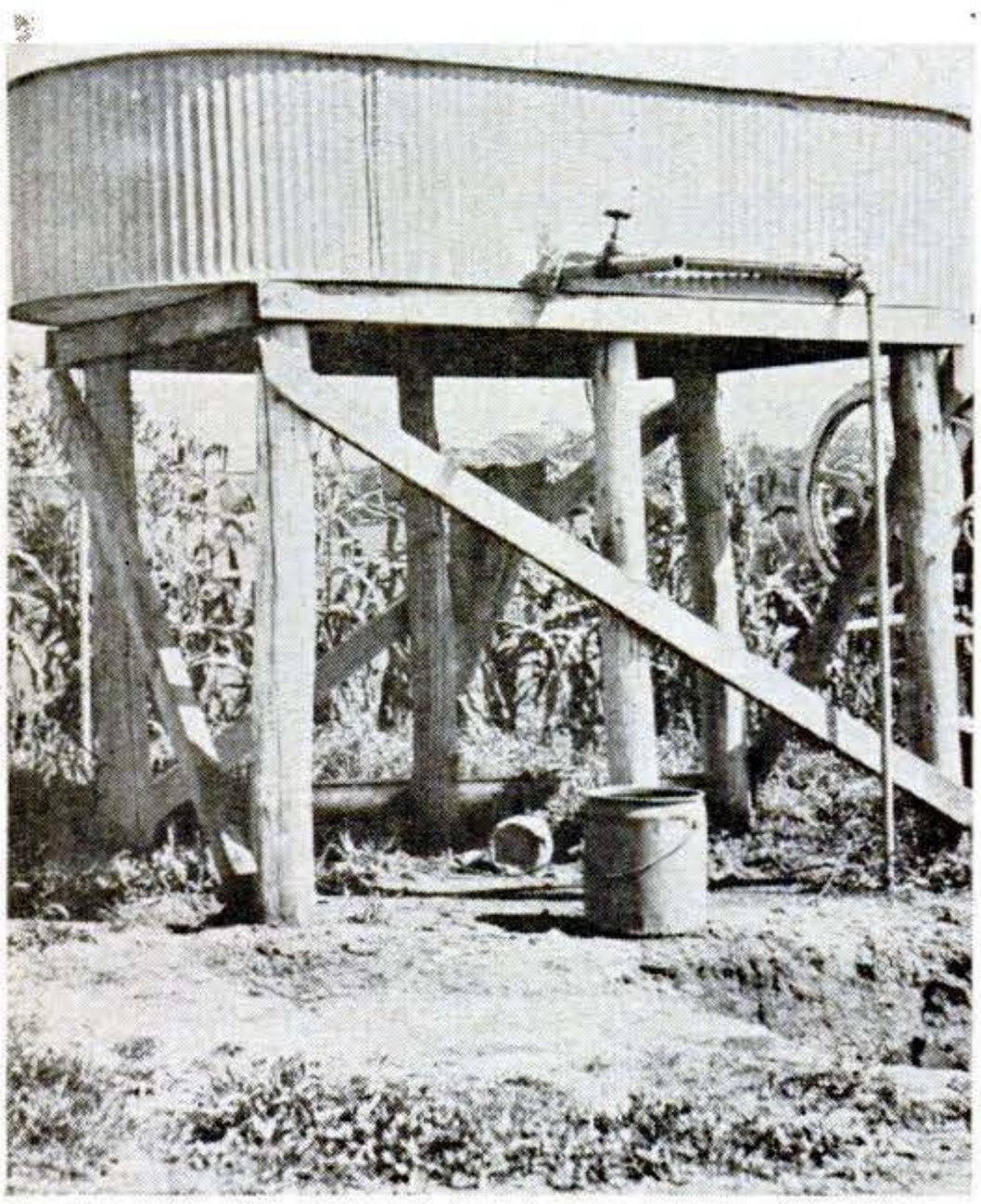
Rubber Boat Fitted with Bicycle Valve



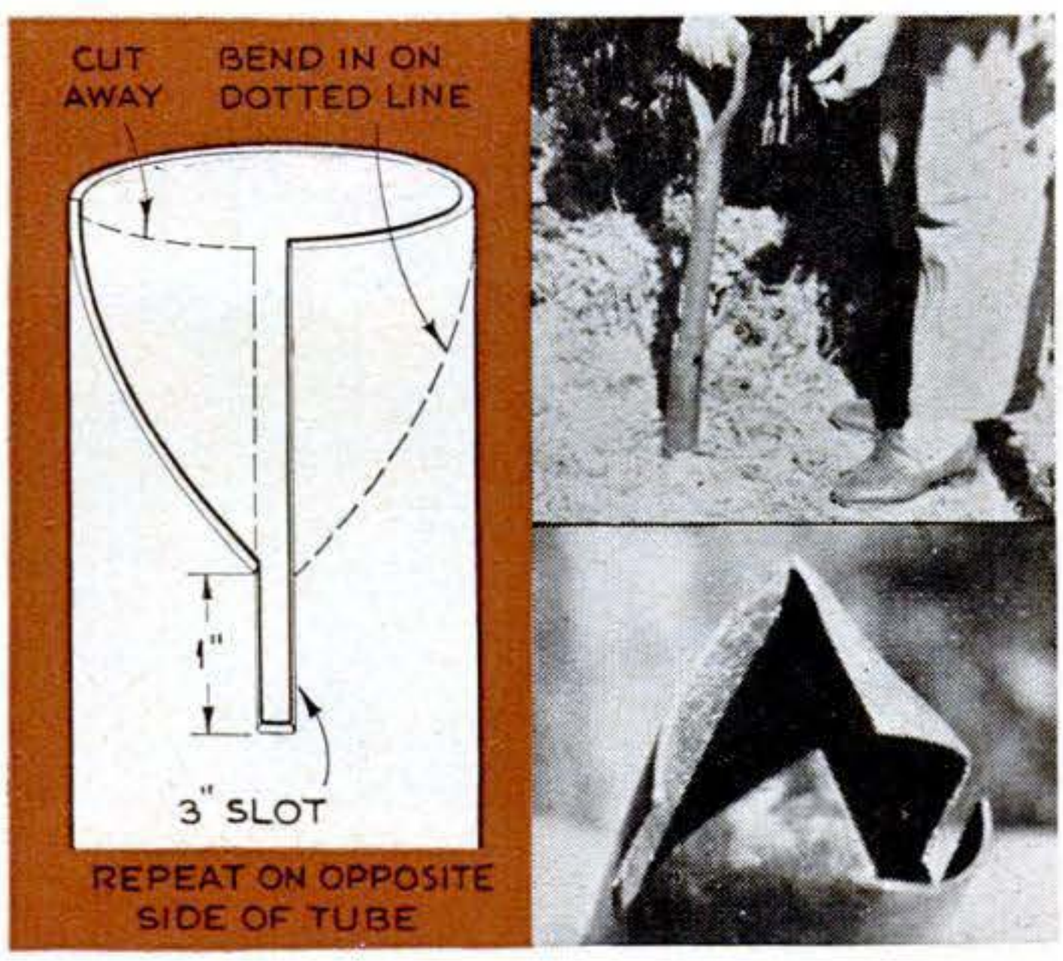
INFLATING a rubber boat with a small hand pump gets to be a tedious job, especially if it's one of the larger boats. I counted 750 strokes to pump up a five-man boat. However, by substituting a bike-tire replacement valve for the special one provided, I now pump up my boat at the nearest filling station and save my energy for fishing and rowing.

Select a convenient place on the boat to locate the valve. The upper surface of one end is a good spot. Cut a hole about the diameter of a lead pencil at this point. Do not cut the hole any larger than the diameter of the threaded portion of the valve. Next cut a hole the same size in the center of a hot or cold inner-tube patch. Apply the patch over the hole in the boat. When it has set, squeeze the hole into a narow line and force the base of the valve through. Slip on the metal disk and screw the collar down tight.—*Norbert Engels, South Bend, Ind.*



Wagon Tank Stores Water

MOUNTED on a platform, a wagon tank serves as a central water depot for hogs and turkeys on the A. C. Gingerich farm near Wellman, Iowa. A force pump fills the tank. Then a tank truck backs up and is quickly filled from the large-diameter outlet of the tank. This system, filling the truck quicker than the pump could, speeds up watering.



Brass Tube Plants Bulbs

BURYING bulbs 6″ to 10″ deep is nearly impossible with a shovel unless you dig a hole big enough for a kettle. The answer is a 1′ section of brass tubing 2½″ in diameter. Across the end of the tube, hacksaw a slot 3″ deep. Then saw away two opposite quarters of the tube as shown in the drawing. Hammer down the remaining two quarters until the points almost meet in the center of the tube, and you'll have a tool that looks like that in the photo. I attached an old shovel handle for a grip. In use, the planter is twisted down into the earth as in the top photo.—*E. J. Hobert, Holderness, N. H.*

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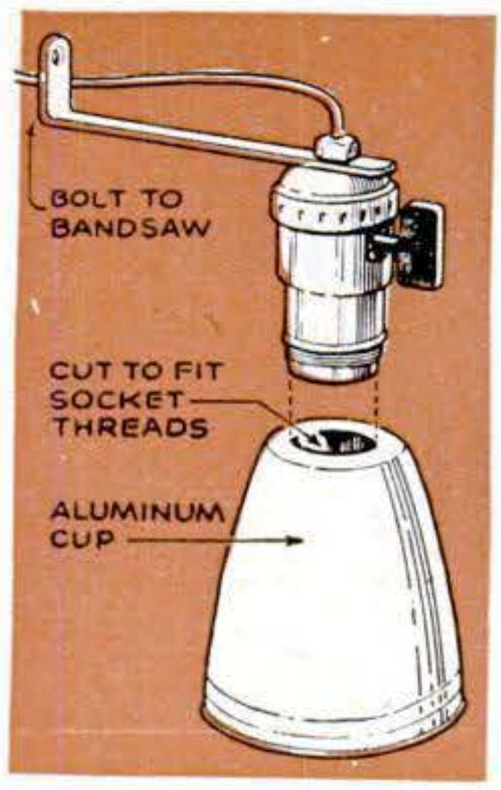
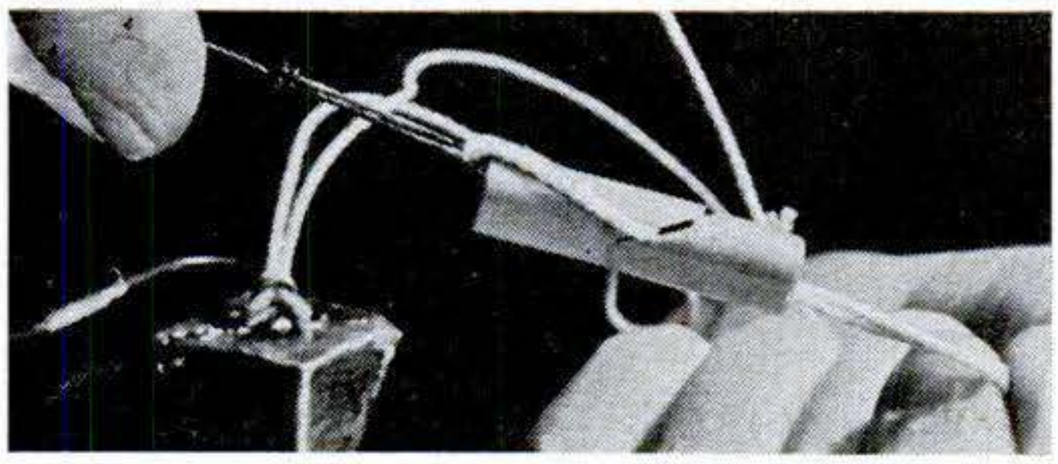
Attachment Lights Bandsaw



A BANDSAW light that focuses on the work can easily be made of an aluminum cup from a vacuum bottle, a keyswitch socket, and a length of strap iron. Cut a hole in the closed end of the cup to fit on the socket threads. Bend and drill the strap iron so that one end can be bolted to the saw. The other end is attached by a drop-cord grommet that threads into the socket.—*V. H. Lamoy, Upper Jay, N. Y.*

Tube Holds Fishing Leader

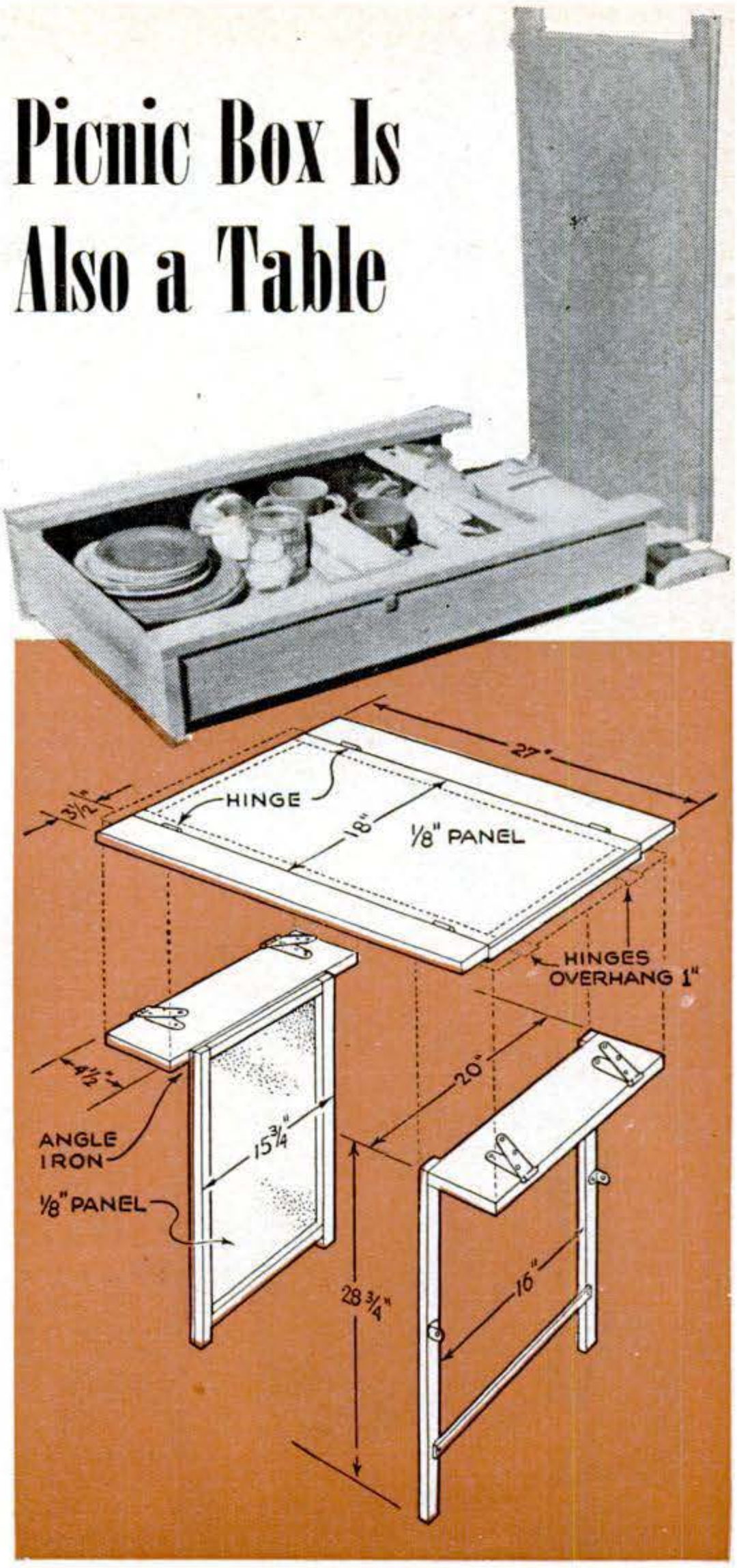


A PLASTIC, metal, or wood tube with a saw slot that makes a pinch fit for a fishing line allows quick attachment or adjustment of a leader. The line is looped through the tube and leader and hooked into the slot as shown.—*A. Marks, Bayonne, N. J.*

Glass Tray Keeps Food Warm

THERE's no trick to keeping a snack at serving temperature when you use this tray. It has a radiant-heated glass top. Plugged into an AC outlet, the tray heats to 200°. Thermostatic control keeps it there. The 9″ by 14″ tray has chrome trim and plastic handles. It's made by Salton Manufacturing Co., N. Y. About $11.

Picnic Box Is Also a Table



GOING on a picnic? You can still eat your lunch thirty inches above the ants if you go prepared with this combined picnic box and table. It carries most of your supplies to start with, and when eating time rolls around you just have to fold down the top and sides to turn the box into a table. The top swings up, around, and down to make one pair of legs, and the other pair swings out the same way.

The unit shown was made mostly of salvaged lumber. All framing stock is ¾″ and panels are ⅛″ composition board. Chief purchased items were four pair of hinges and four metal angles. Construction is simple, with plain butt joints. A light sanding and spar varnish finish it off.—*Robert Hoppough, Waukegan, Ill.*

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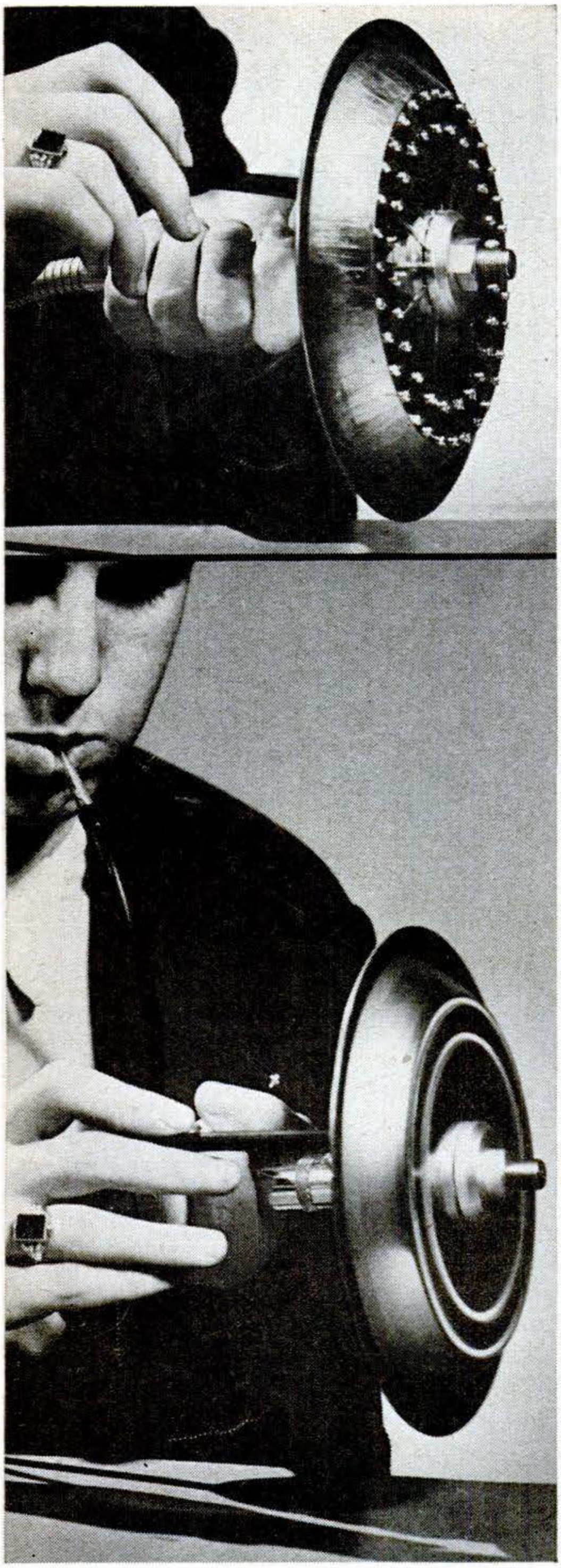

A siren generates sound waves when air blows through holes in a revolving disk. You can use a pie tin as the disk. In its bottom, punch a couple of rings of evenly spaced holes. Mount the tin on a motor shaft, start up the motor, and blow through a length of rubber tubing. Concentric rings of 24, 27, 30, 32, 36, 40, 45, and 48 holes will produce a full octave.

Sound Waves in Action

WHEN a long train starts, you can see the first tug travel back from the engine through car after car. Compression waves carry sound much the same way.

All sounding bodies are in a state of vibration. Because of elasticity of the air or other carrying medium, the vibrating action causes alternate compression and expansion outward from the source.

Sound is a complex subject. You could spend a lifetime studying it. But there are a number of simple experiments that will give you an understanding of its basic characteristics.

You can produce sound by any means that gives vibrations within the frequency range audible to the human ear—from about 20 per second up to around 20,000 in exceptional cases. The homemade siren at the left is a good way to start your study.

From this, proceed to the experiments on the opposite page. The howler is a variation of a trick you've often done with empty bottles. Here, you get not just a single tone, but a howl of varying pitch. The vibrating air within the tube disturbs the water below.

For the sensitive flame, make a jet by drawing glass tubing to a point in a gas flame. Cut off the end square, leaving a hole not greater than 1 mm. in diameter. If the flame won't dance on the first try, file the jet to make the hole a trifle larger. The size of the hole is quite critical.

Connect the jet to your domestic-gas supply. Be sure to regulate the flow at just below the roaring point. If the flame refuses to roar, the pressure is too low for the stunt. Sound waves impinging upon the gas flowing from the jet cause the flame to dance.

Use the same jet for the liquid experiment. Set up the apparatus as shown at the bottom of the page. Put ordinary photographic hypo in the glass, iodine dissolved in a solution of potassium iodide in the bottle.—*Kenneth M. Swezey, Brooklyn, N. Y.*

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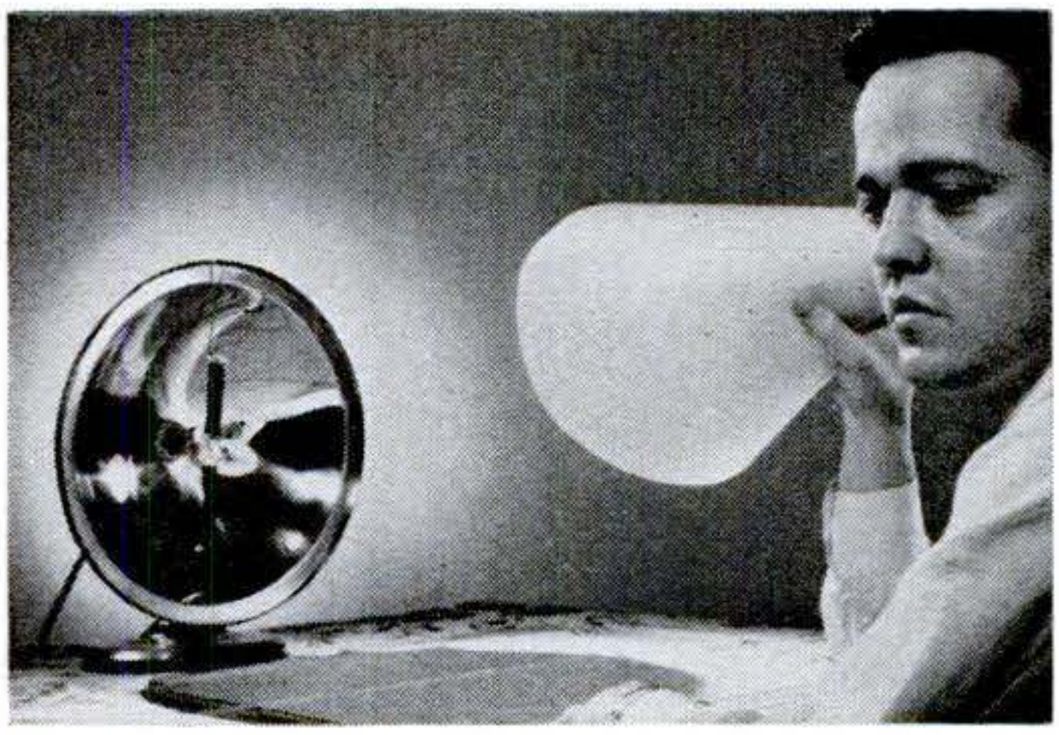
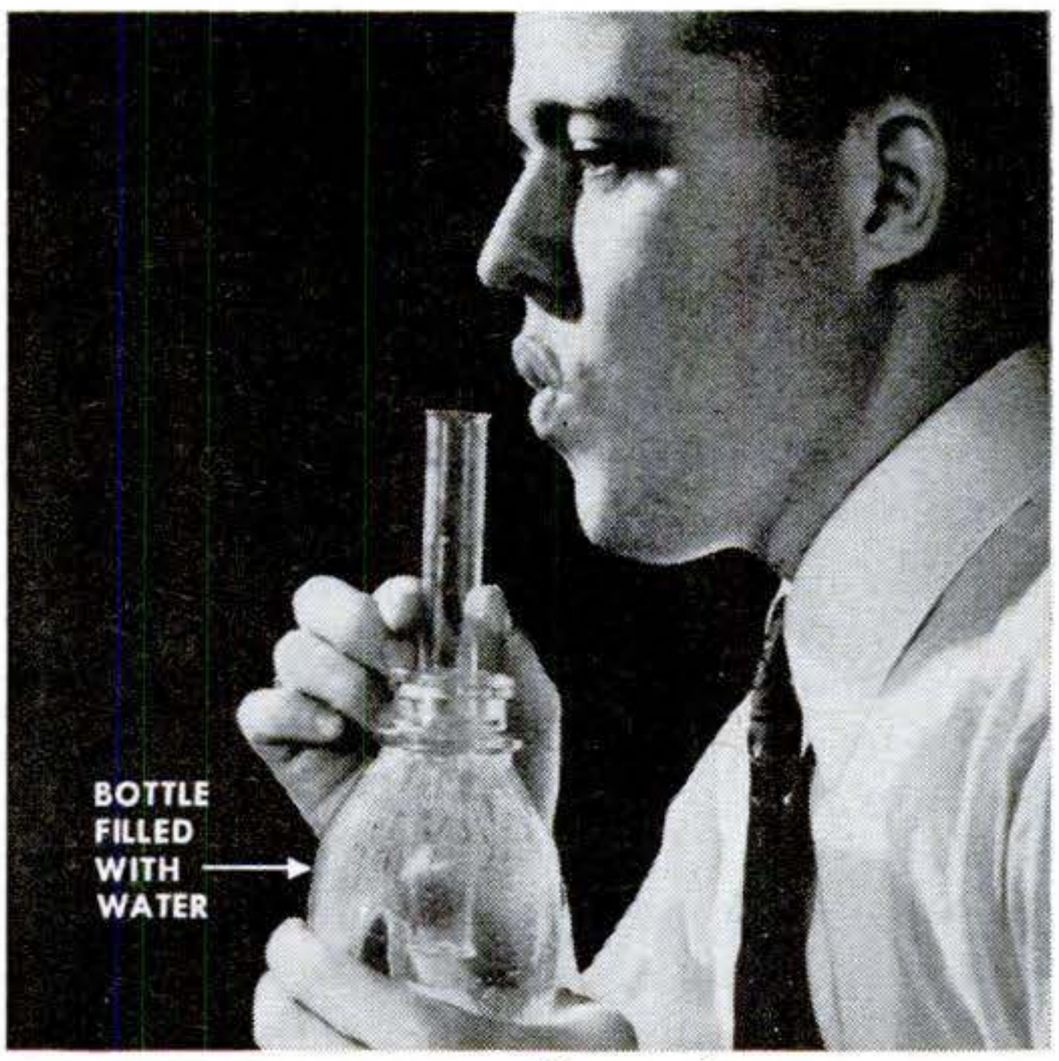
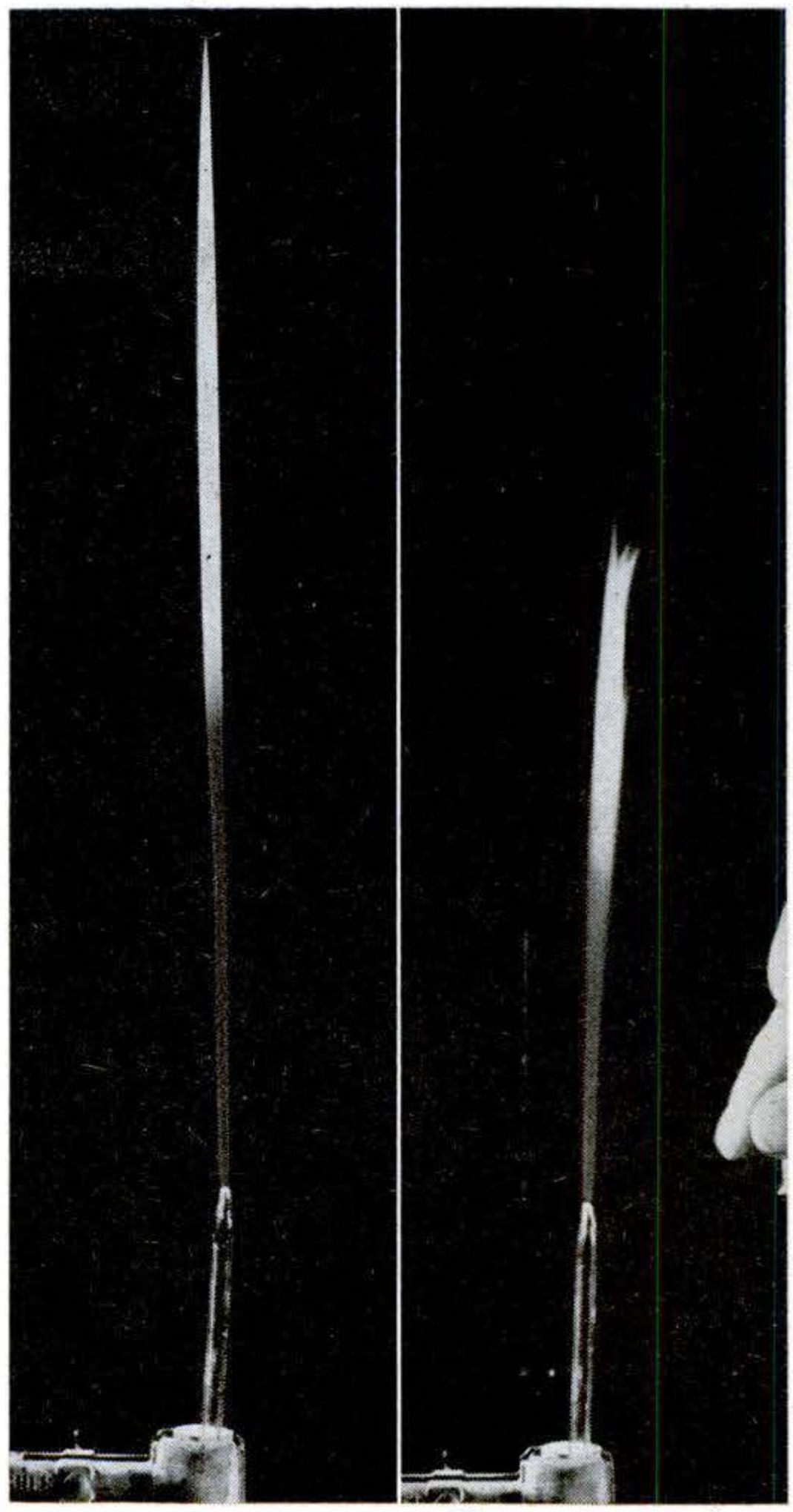


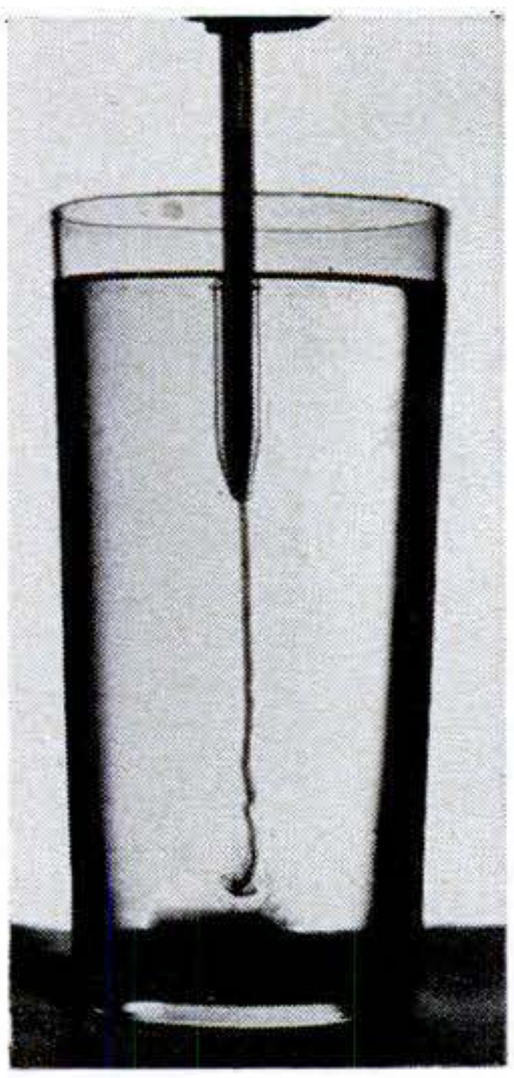
You can focus and reflect sound waves. Suspend a watch over the center of an electric-heater reflector, put a cardboard cone to your ear, and you will hear the ticks many feet away.

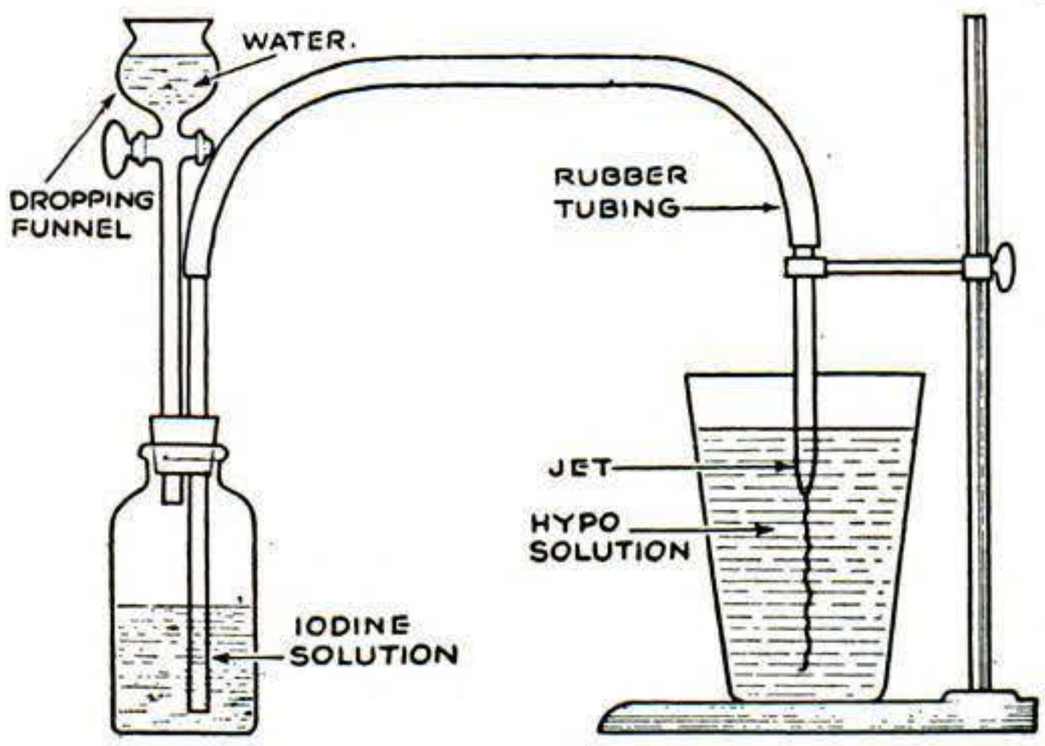


Homemade howler works on the same principle as organ pipes, whistles, and flutes. Blowing across tube sets enclosed air into vibration. Raising or lowering the tube varies the pitch.

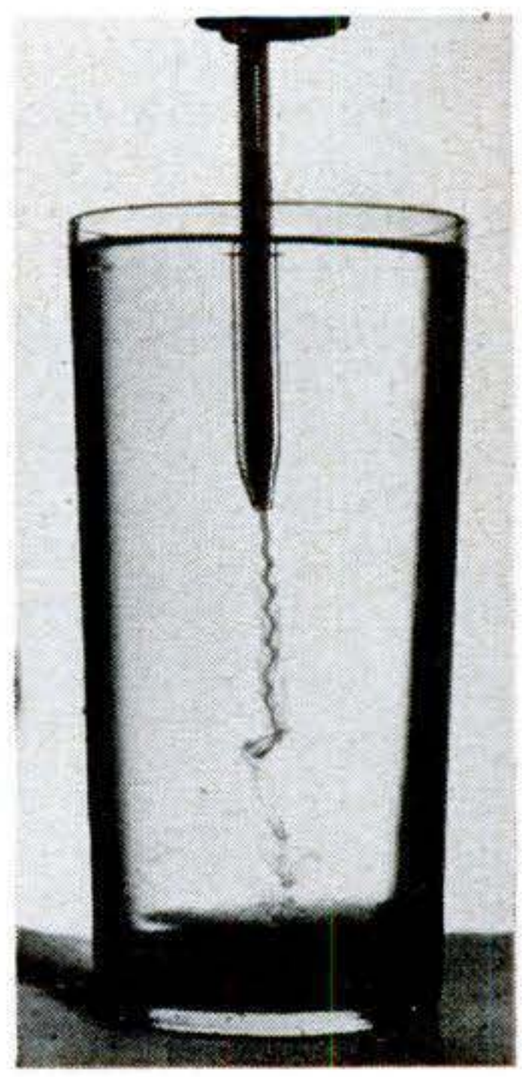


Sensitive flame gives visible evidence of the presence of sound waves. Regulate gas coming from jet so it's just below point where flame roars. Snap your fingers and flame will dance.





Liquids respond to sound waves, as this test shows. Put water into the funnel and let it run into the bottle at rate of a drop per second. Pressure forces iodine solution to flow. If the room is quiet, flow will be straight as at left. Sharp sound produces result at right.



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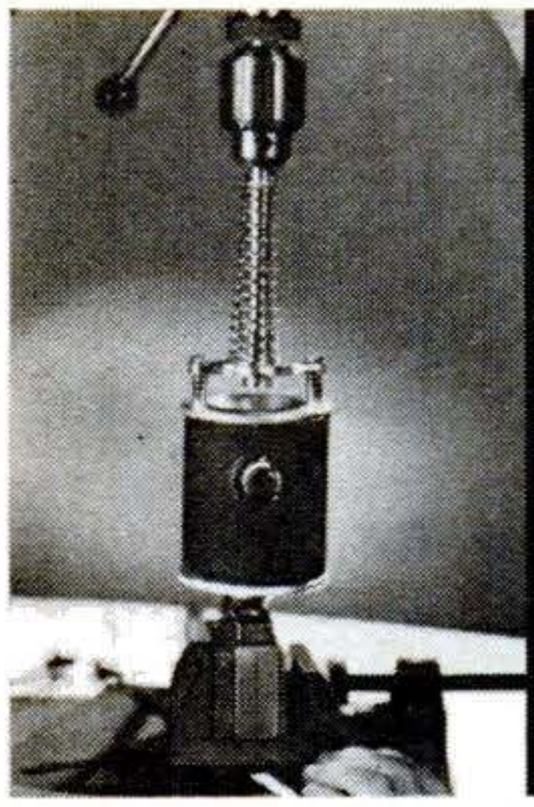
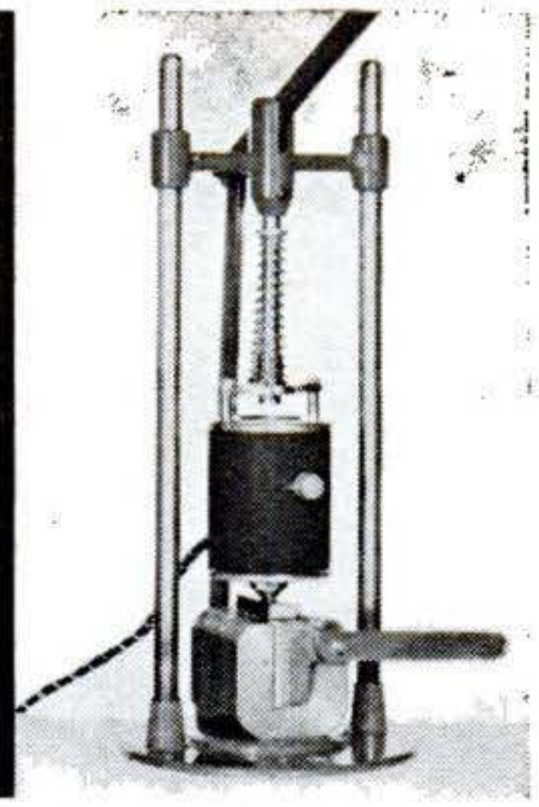
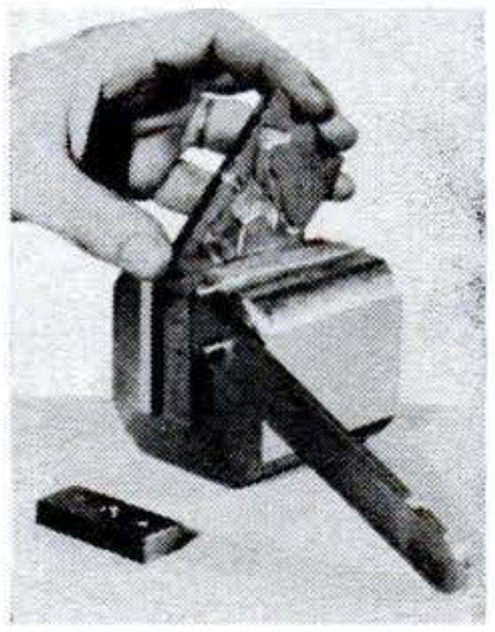




Injection molding unit is shown at left chucked in drill press. At right, it is being used with the press manufactured for the purpose. Center photo shows some of the objects turned out by the machine. The inset below shows the mold being removed from a quick-acting vise.

Home Press Molds Thermoplastics



DESIGNED for either short runs or quantity production, Plast-O-Press® turns out 75 injection moldings an hour. The machine, manufactured by Plastics Development Corp., New York City, retails for about $40. Experimental dies cost from $2 to $3.50. Dies made to order run from $3 to $10.

The unit can be chucked in a drill press or in a low-cost press built for the purpose by the manufacturer. In use, powdered plastic is poured into the chamber and the heat turned on. Temperature range is from 250° to 500° F. A mold then is locked in a clamp or vise beneath the chamber. The press handle is lowered with moderate pressure to force plastic into the mold.

Plast-O-Press has a capacity of ¼ oz. and a piston diameter of 9/16″. It operates on 110-115 volt AC-DC and draws 100 watts. Mold sizes are: 1/16″ by 2½″ by 2½″; 1/16″ thick by 3″ in diameter: and ¼″ by 1½″ by 1½″.

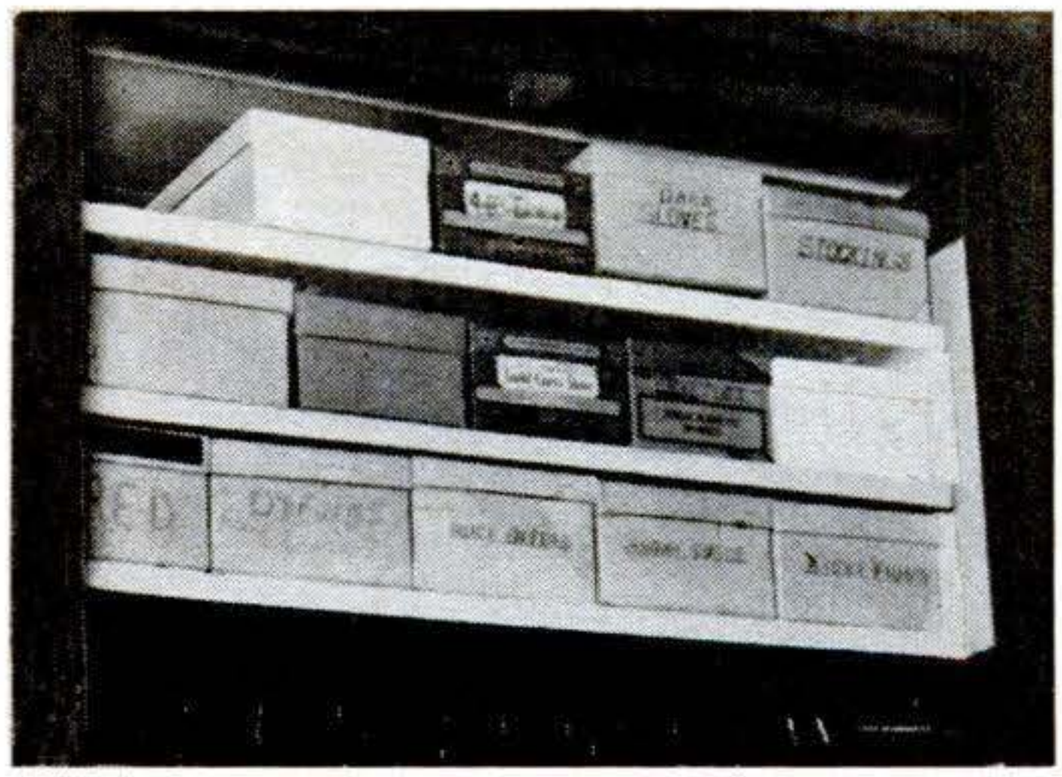
Thermosetting plastics used in the unit are available in standard colors from the manufacturer in 1-, 5-, and 10-lb. cartons. Colors may be mixed to give a marble-like effect in the finished work.

One of the machine's most interesting uses is molding heads or knobs around screws. This is particularly useful in electrical and radio work. Such metal parts are inserted in the mold beforehand, so that the injected plastic flows around and locks them in.

The two halves of the mold can be clamped together in a drill-press vise or even with C clamps. A quick-acting vise, shown above, has a wedge to lock the mold in and a lever that instantly releases it.

Among the standard molds are buckles, checkers, buttons, and curtain pulls.

Shoes Stored Out of Way in Shoe Boxes



OF ALL the solutions to the problem of storing shoes in the home, the simplest is probably the method used by shoe stores. Put the shoes back in their original boxes and stack them on shelves.

The shelves shown in the photo at left were put up without nails. They're simply boards resting on sidepieces 1″ thick. This arrangement simplifies taking the boards down for cleaning. Distance between shelves should be 4½″ to 5″. For men's shoes, shelves should be 13″ deep. Label the boxes. —*A. W. Drieling, McKeesport, Pa.*

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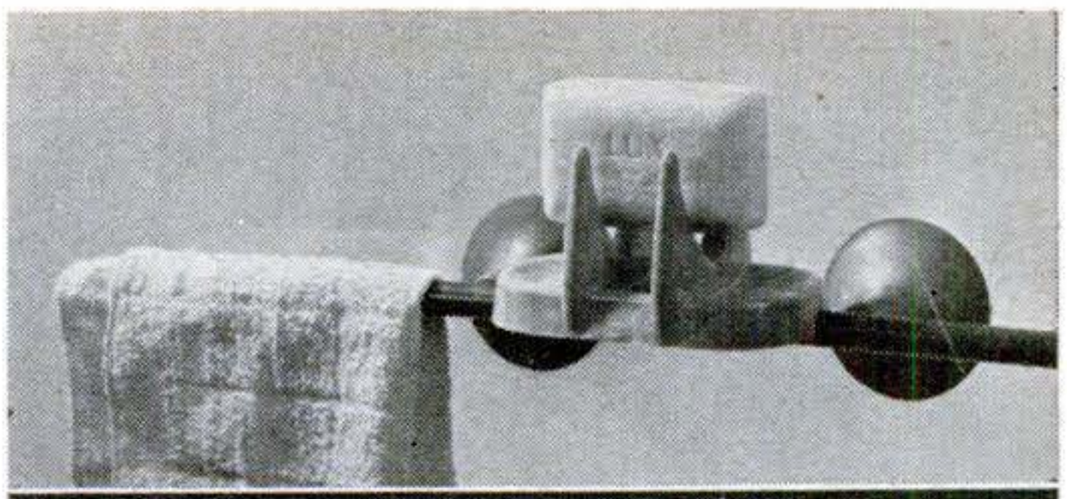
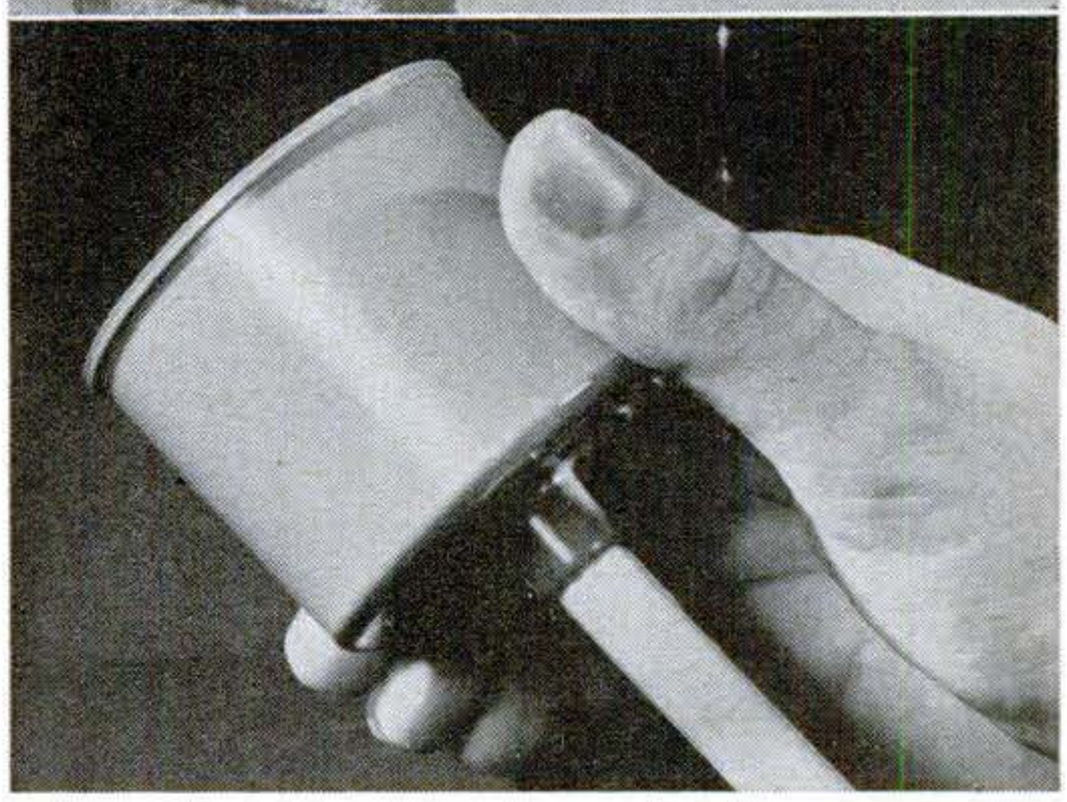
Plastic Gadgets Answer Needs

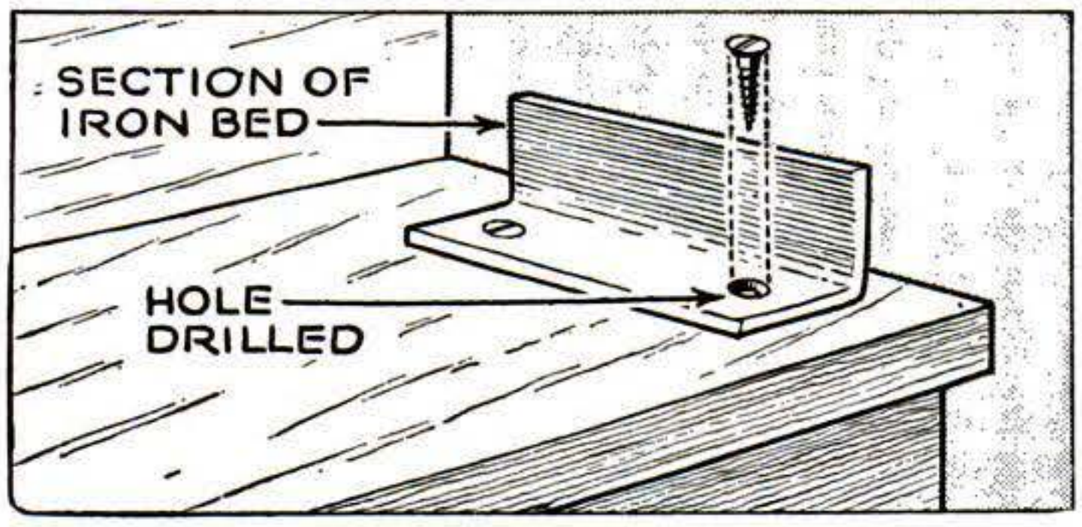
FOLLOWING suggestions in PS' "I'd Like to See Them Make" department, two companies report that the products requested are now on the market.

The top photo at right shows a soap and washcloth holder that sticks to a smooth vertical surface with suction cups. For over-the-tub showers, a curtain with pockets to hold brushes, soap, and cloths was suggested. The holder shown here, manufactured by George M. Acker Co., Los Angeles, is priced at about $2 and comes in three colors.

Pictured in the lower photo at right is a plastic measuring cup with a push-up bottom. It's used to measure shortening for recipes. It can be set for the amount—from ¼ to 1 cup—and the shortening shoved out after filling it. Priced at 50 cents, it's distributed by Mutual Enterprises, Chicago.

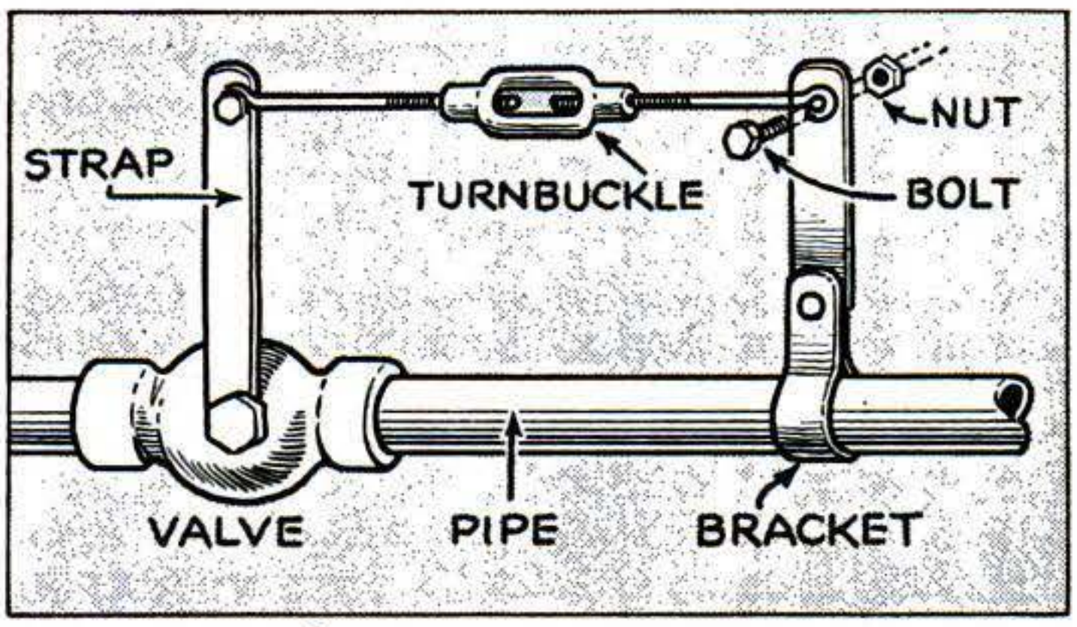






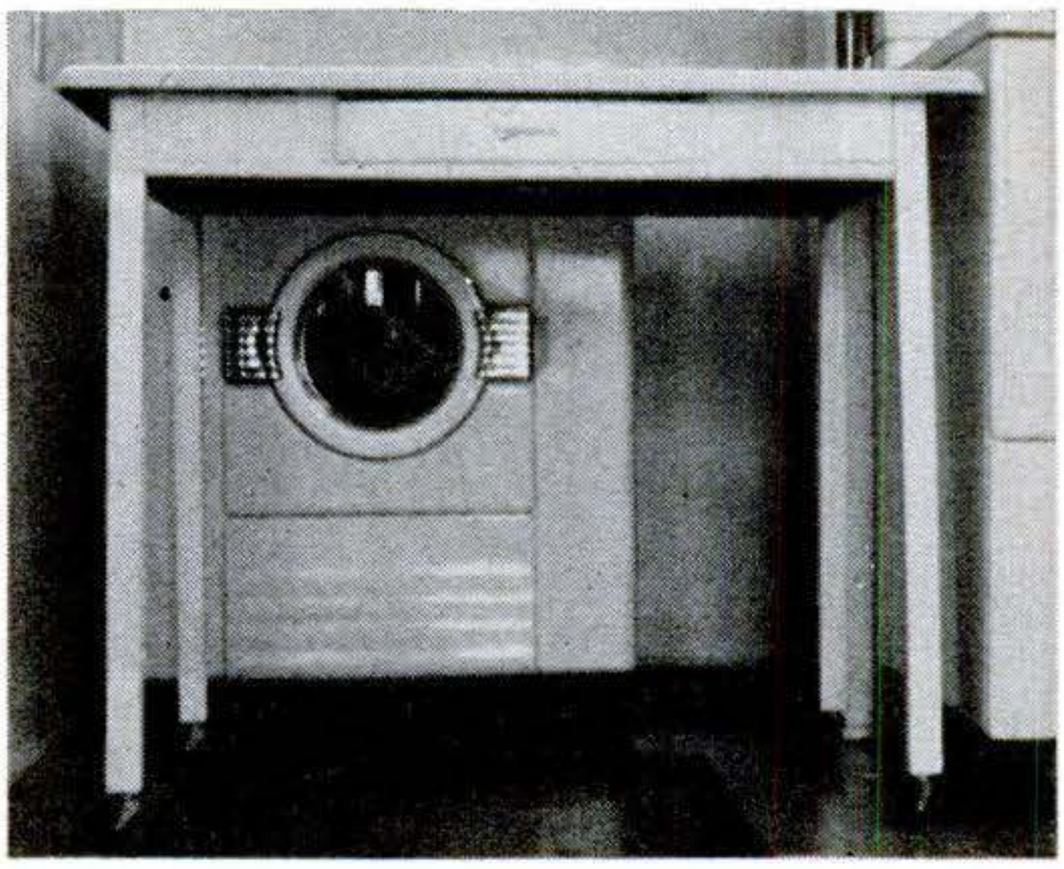
Scraper Cut from Old Bed

A SECTION of angle iron, cut from the side-piece of an old bed, makes an excellent shoe scraper. Hacksaw the section to the length you want and then drill a hole near each end. Paint it carefully and fasten to the edge of a porch or on a step with wood screws.—*Victor H. Lamoy, Upper Jay, N. Y.*



Turnbuckle Sets Valves

MANUALLY operated valves that must be set exactly are often troublesome if you make the fine adjustment freehand. I solved the problem with the setup shown in the sketch. The handwheel was removed and a short strap substituted. A bracket was attached to the pipe a short distance from the valve and a turnbuckle rigged between. With the turnbuckle removed, a rough setting is made with the strap. Replaced, the turnbuckle makes the fine adjustment.—*George Burnley, Oakland, Calif.*



Utility Table Rolls to Work

LARGE rubber-tired casters added to an old kitchen table converted it to an all-round utility table. Since it stands up high on the casters, it's handy beside a stove or ironing board when extra table space is needed. It also acts as a hand truck for hauling large grocery orders from the back door to the cupboard.—*I. S. Collis, Albuquerque, N. M.*

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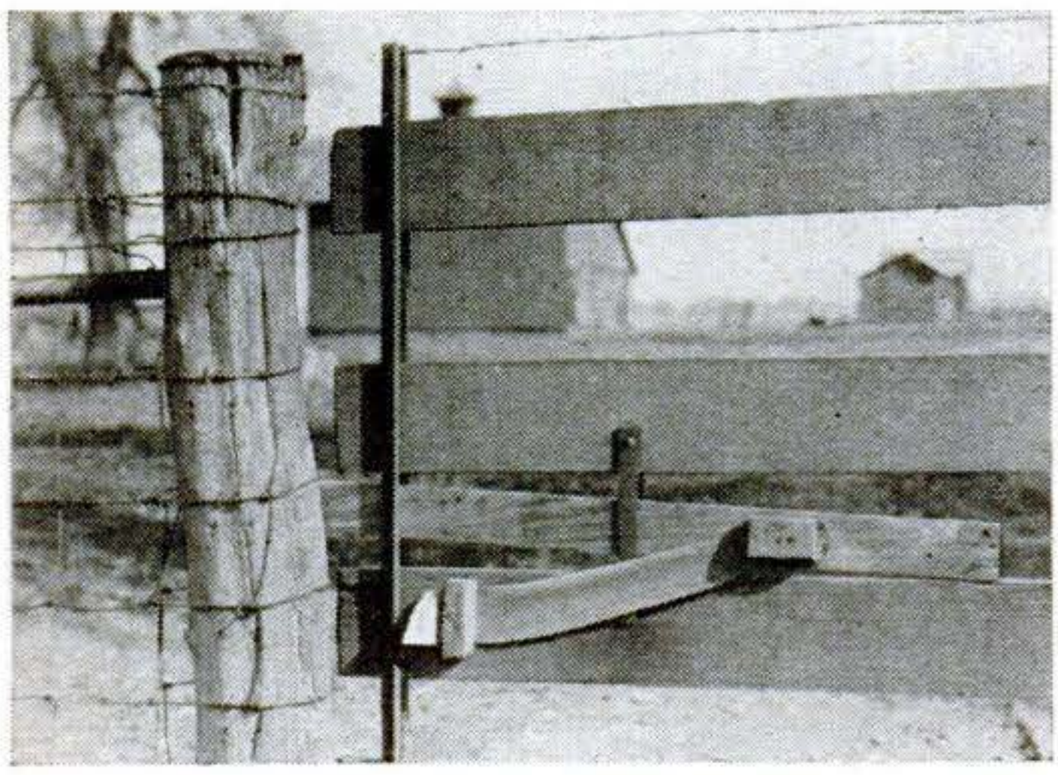
Jet Engine Heats Orchard

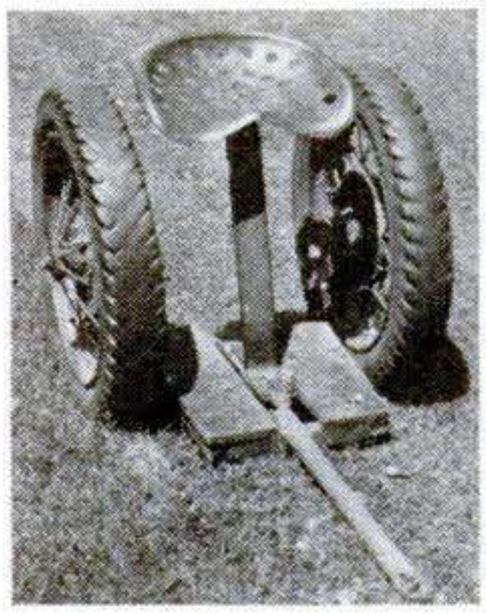
ORIGINALLY designed for aircraft, a jet engine was converted to an orchard heater by Edward West, Jr., of Los Angeles. At high velocity, hot air is blasted out of the jet pipe, which is slanted toward the ground when in use. The air is deflected under the trees for two or three rows on each side of the heater. Weighing 200 lb., the heater uses the same fuel burned in smudge pots. In tests, the jet produced the same heating effect as 100 smudge pots, and of course requires less attention. In background is a motor-driven prop used by some growers to protect crops from frost.



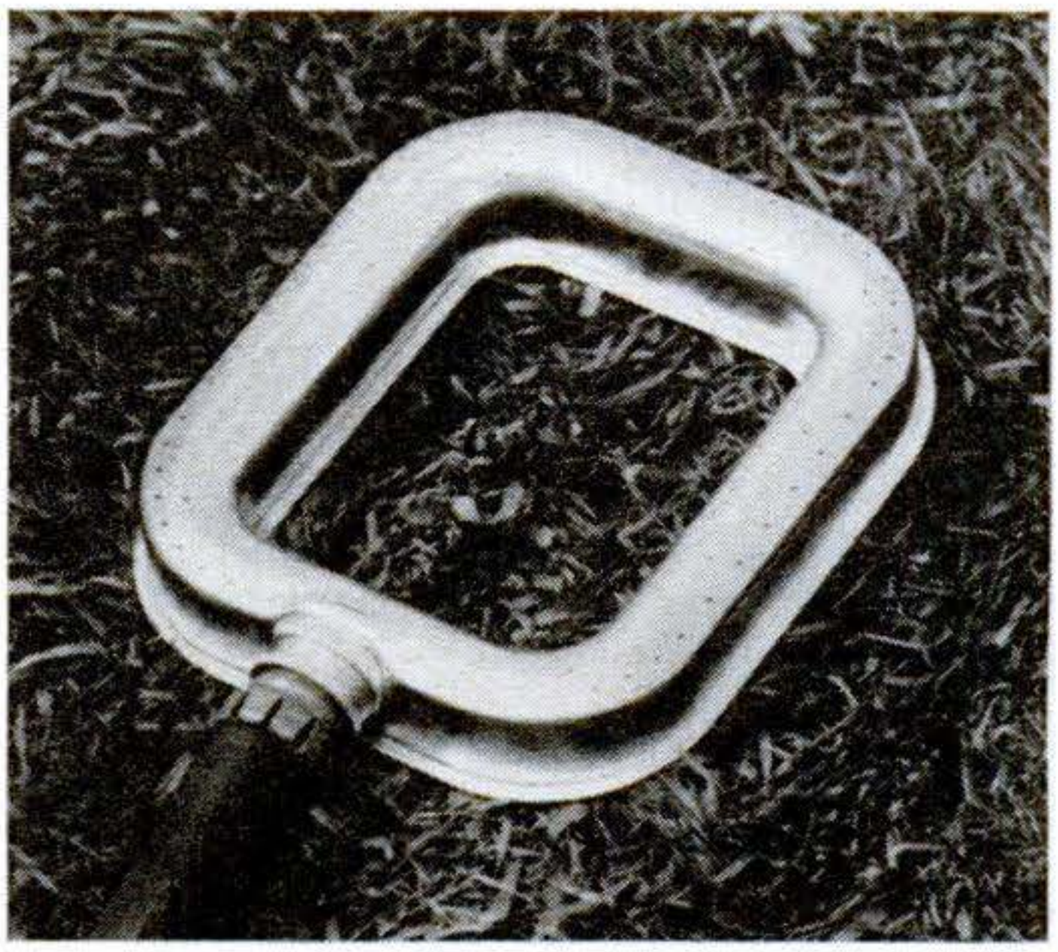
Rubber Holds Gate Latch

A STRIP cut from an old inner tube securely holds the pull-type latch of this gate in place. Stock or wind can't shake the gate open. The rubber is held by blocks nailed to the gate.—*A. M. Wettach, Mt. Pleasant, Ia.*

Mower Pulls Trailer Seat



HERE'S what many owners of power lawn mowers dream about—a trailer with a seat. The mower tows you around the yard as it cuts the grass, if the motor has enough beef. This trailer has a welded frame slung between a pair of scrap Model-A Ford wheels. The seat was salvaged from an old cultivator. Top photo shows Cleo Lange, Mt. Union, Ia., aboard.



Square Squirt Squirts Squares

MANUFACTURED by the Melnor Metal Products Co., New York City, the Square Squirt® is designed for use on rectangular lawns. According to the company, it throws water into corners that the conventional sprayer can't reach without waste. It is made of brass with a standard hose fitting, has no moving parts, and is priced at about $2.

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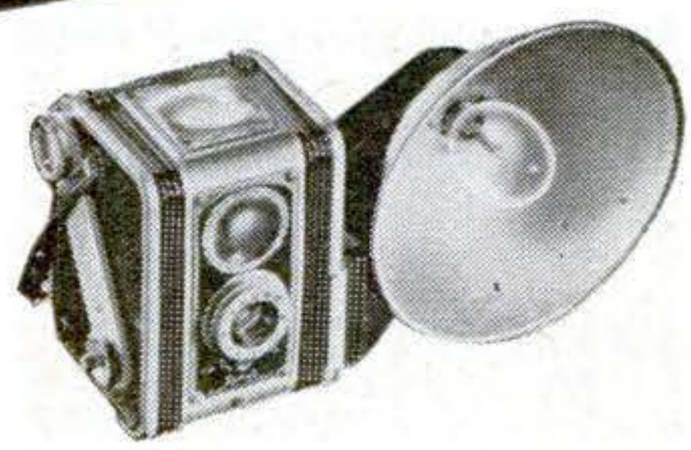
Meet the NEW Kodak Duaflex Camera with Kodar f/8 Lens

Here's the De Luxe Model of the popular Kodak Duaflex Camera. Lens sets in a jiffy to *f*/8, *f*/11, or *f*/16. You don't have to wait for the sun to shine before taking pictures. Open the lens wide to *f*/8 . . . turn the focusing lens mount to correct distance setting . . . look through the brilliant reflex finder, and shoot. The two other settings "get the picture" in varying degrees of daylight. Lens can be focused from 3½ feet to infinity.

Automatic Shutter-Lock prevents double exposures. Ingenious new control "remembers" for you—makes sure you can't spoil a good picture by tripping the shutter twice on the same negative. After each shot, the shutter-release locks until you advance film. You get 12 negatives, 2¼ x 2¼, on black-and-white Kodak 620 Film, or 9 full-color pictures on Kodacolor Film.

Prices include Federal Tax
(Prices subject to change without notice)

$19.85 including neck strap and lens shield



Flasholder for both Duaflex models—$3.33

See it at your Kodak dealer's. Also ask to see the Kodak Duaflex Camera with Kodet lens . . . everything's adjusted at the factory; all you have to do is aim and press the trigger. $13.50.

EASTMAN KODAK COMPANY, ROCHESTER 4, N. Y.

Kodak

"Kodak" is a trade-mark

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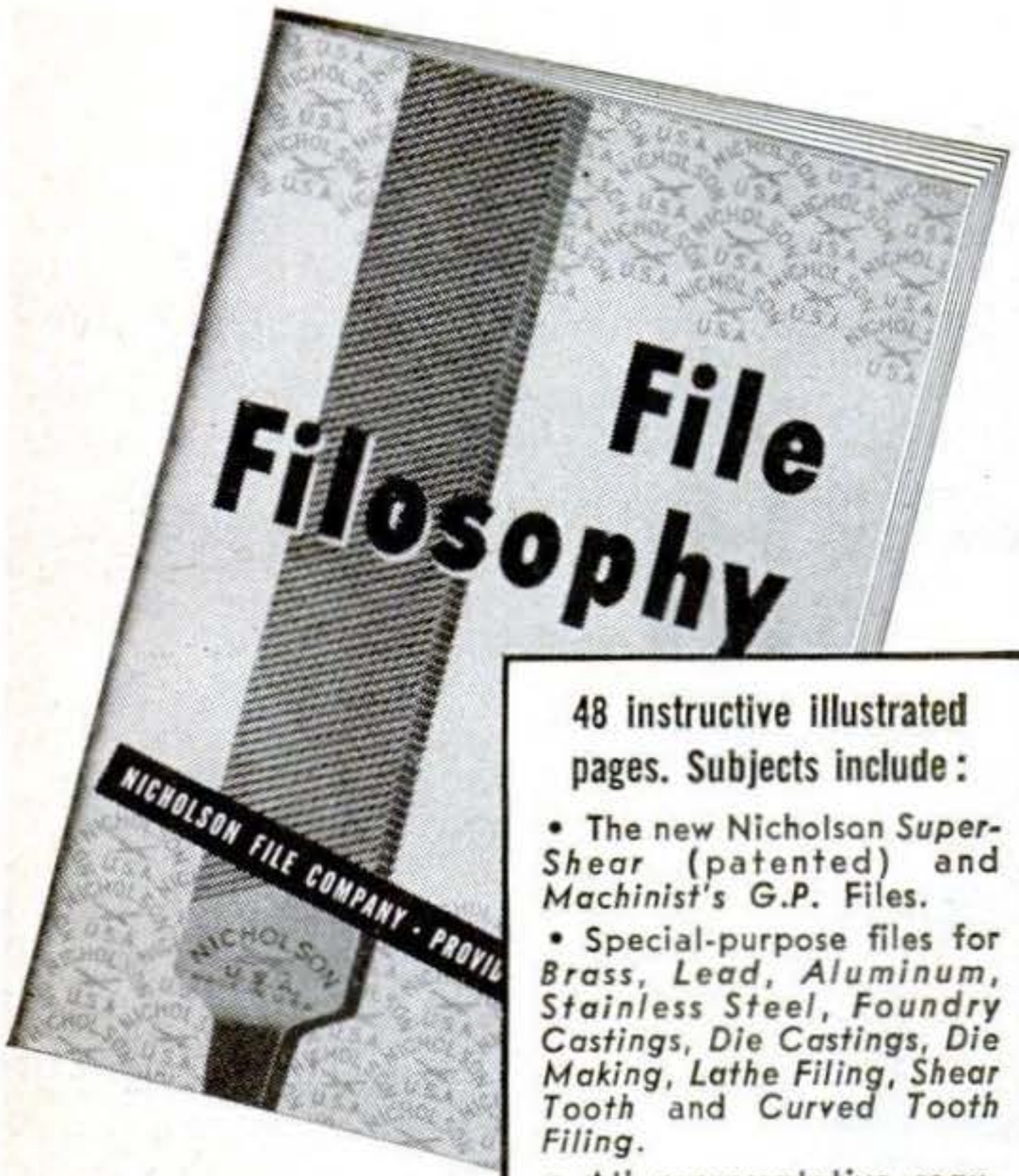
NEW EDITION



48 instructive illustrated pages. Subjects include:

- The new Nicholson *Super-Shear* (patented) and *Machinist's G.P.* Files.
- Special-purpose files for *Brass, Lead, Aluminum, Stainless Steel, Foundry Castings, Die Castings, Die Making, Lathe Filing, Shear Tooth* and *Curved Tooth Filing*.
- All representative regular-purpose files and rasps.
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FREE to home craftsmen, inventors, model builders, die makers, industrial and machine-shop mechanics.

USE COUPON (or letter or post card) to request a copy.

"FILE FILOSOPHY," a practical guide in the art of filing, has become universally accepted as an authority in its field. Mechanical and technical experts have used it as a foundation for articles in the mechanics and industrial press. It is a recognized "textbook" in hundreds of mechanical training schools.

This latest edition comes to you in up-to-the-minute form and reflects the leadership Nicholson holds as the largest and one of the oldest and most progressive file manufacturers in the world.

NICHOLSON U.S.A.

NICHOLSON FILE COMPANY
Providence 1, R. I.
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BLACK DIAMOND TRADE MARK

NICHOLSON FILES *FOR EVERY PURPOSE*

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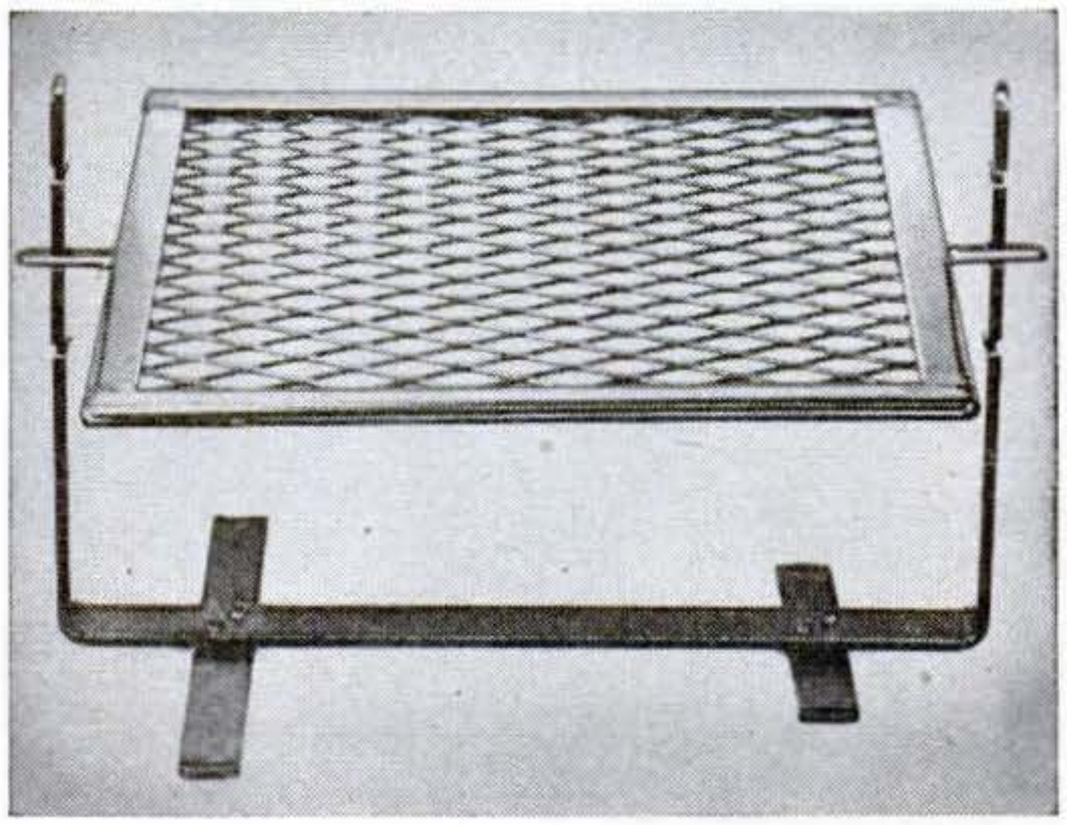
Send copy of the new 1949 edition of "File Filosophy."
Name _____
Address _____
_____
I am a _____
(State if home craftsman, regular mechanic, or other file user.)

Delivery Car Opens Easily

You can lift the chrome-plated handle of this Harley-Davidson Servi-Car® with one hand—leaving the other free for loading bundles. The cover of the car's package compartment is reinforced by X-shaped metal strips, made of cold-rolled sheet steel.



Grill's Height Is Adjustable

THIS new 15- by 17-inch grill, for cooking on either indoor or outdoor fireplaces, is supported by a U-shaped frame with notches that let you adjust the grill to six, eight, or 10 inches above the fire. It can be disassembled easily and stored in a small place. Walter Burge, of Sherman Oaks, Calif., developed the Barbegril®.

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CHAMPION

SPARK PLUGS

America's Favorite!

In parking lots anywhere, you'll find cars of practically every make and vintage. If you were to lift the hoods of all of them, you'd find the majority —regardless of make—equipped with dependable Champion Spark Plugs. We've made this test over and over again, definitely proving that Champion is America's favorite spark plug—obviously the result of better performance. This leadership in public acceptance has continued for over a quarter century! Champion Spark Plug Company, Toledo 1, Ohio.

FOLLOW THE EXPERTS

USE THE SPARK PLUGS CHAMPIONS USE!

Listen to the CHAMPION ROLL CALL . . . Harry Wismer's fast sportscast every Friday night, over the ABC network

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New TOOL'N'RAK

HANGS UP WHERE YOU WORK

for
wood
metal
leather
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plastics
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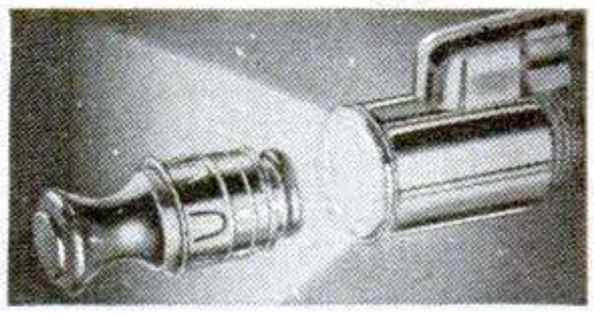
It drills!
It saws!
It carves!
It sands!
It sharpens!
It polishes!
It etches!
It grinds!
It cuts!

ALL 40 PCS. 17.95 COMPLETE

Complete with every motor-driven tool you need to build models, fashion jewelry, etch glass, tool leather, carve plastics, rout metal... to fix, make, repair, and create... *plus* 1001 time and money-saving uses around your home! Beautifully-finished solid hardwood rack keeps everything at your fingertips—yet hanging up out of your way! Vibrationless 27,000 RPM fractional HP motor, AC-DC. Radio Static suppressor. 36-page Project Book FREE! Now at Department, Hardware, Auto Supply, Appliance, and Jewelry stores **17.95**

VIS-O-LITE



Casco's amazing new car lighter!

Eliminates fumbling in the dark!
Helps keep your eyes on the road!

Press it in—VIS-O-LITE pops out *automatically* when ready! While you're lighting your cigarette, the lighter well glows softly on your dashboard. Guides your hand surely back. Easy to install... **$2.75** complete.

Note: You can bring your present Casco lighter up to date with the illuminated well alone... for only **$1.50**

RENEW YOUR OLD CAR LIGHTER only $1

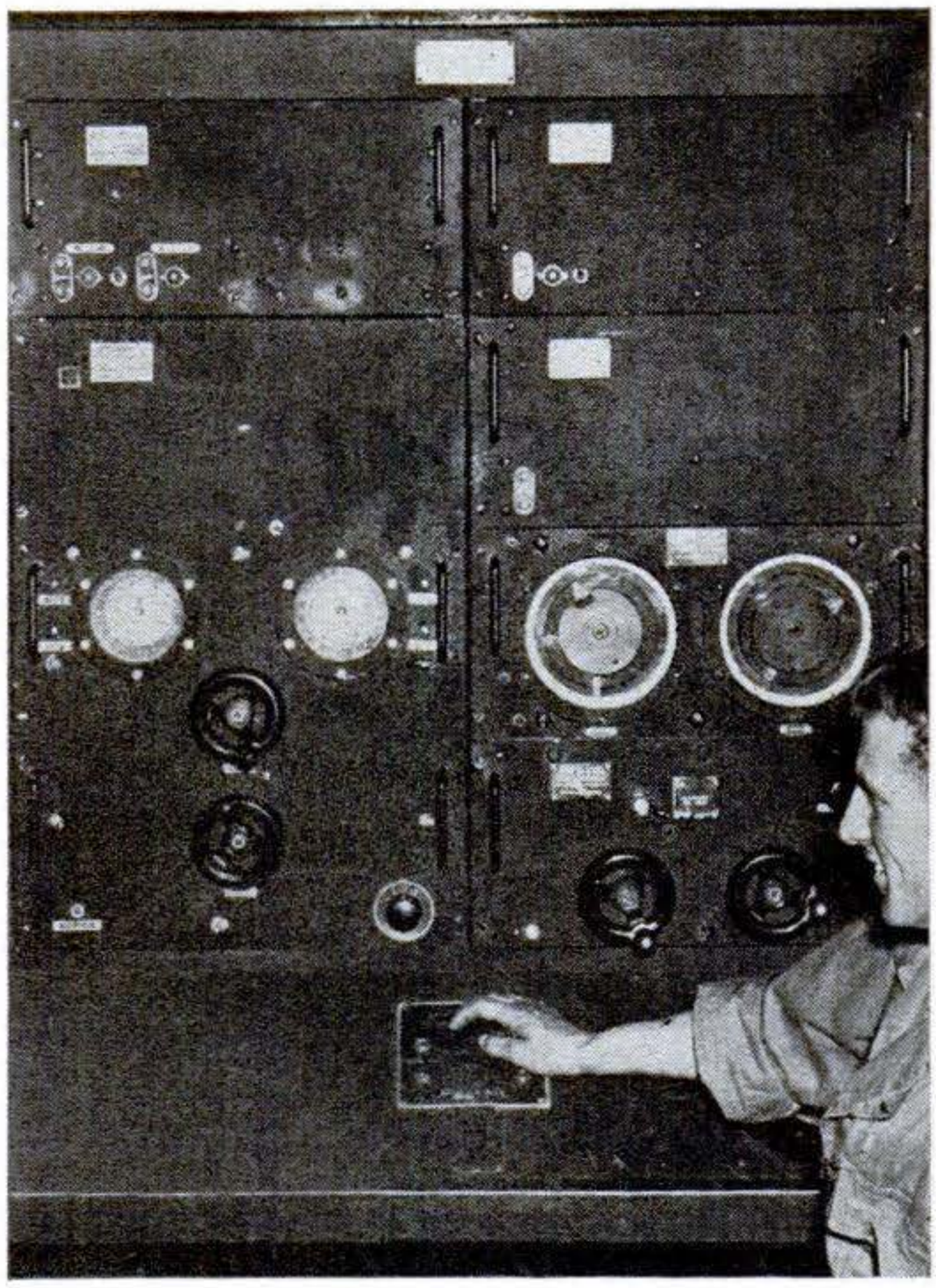
Heating element worn out? Just screw-on another Casco unit.. **$1.00**

(9 out of 10 car lighters are Casco-made. Insist on genuine Casco Replacement parts!)

Lighter unit lost? Replace it with a complete new Casco Pop-out unit... **$1.50**

Now featured at Car Dealers, Auto Supply Stores, Garages, and Gasoline Service Stations!

CASCO CASCO PRODUCTS CORPORATION BRIDGEPORT 2, CONN.



This radar set tells where practice bombs would hit—if there were any bombs. An SCR 584, it tracks automatically when planes near target.

Radar Rates No-Bomb Blitz

IN THE past two years our Air Force has bombed more than 11,000 important industrial and strategic targets. There have been no casualties, either among the attacking planes or in the bombed cities. The reason: the targets were real U. S. cities—but the bombs were imaginary.

Training bomber crews now requires real targets and imaginary bombs, instead of the other way around, because radar is used almost exclusively. The radar-scope picture of a landmark that identifies the target looks quite different from an aerial photograph of the same landmark. So the radar men must learn to recognize bridges, railroad yards, and so on, by flying over the real thing. That means their bombs can *not* be the real thing.

To score the training crews on the accuracy of make-believe bombs, the Air Force uses radar sets. A ground crew near the target tracks the bombing airplane and gets a radio signal at the instant of "bombs away." Knowing the plane's speed and direction, wind direction, and ballistic data for the "bombs," the operators can compute the point that would have been hit—if there had been a real bomb.

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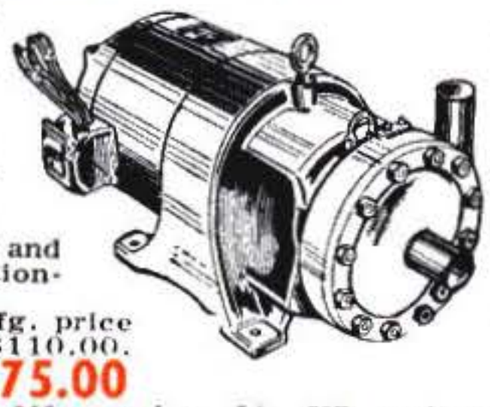
RED ★ WAR *SURPLUS* $$$$ SAVERS

RED STAR ON ITEM INDICATES IT IS AT ROCK BOTTOM PRICE

★ CENTRIFUGAL PUMP



1" intake and outlet. Drip proof motor, (Master). 45 gal. per min. at a 20' head. Ideal for condensate, sprinkling, circulating water in cooling systems and for air conditioning units.
AC-110 volt, Mfg. price ⅓ HP unit—$110.00. **Stock #532.** Our price... **$75.00**
AC-110 volt. Mfg. price ½ HP unit—$120.00. **Stock #532.** Our price..... **$80.00**
BELT DRIVEN PUMPS 1" intake. ¾" discharge. With release valve. ⅓ HP capacity. 110 volt motor. **Stock #538.** Our price..... **$49.50**
BELT DRIVEN PUMPS. Same as above, ½ HP. **Stock #539.** Our price..... **$64.50**

★ Jack and Heinz Electric Motors

New. ⅓ HP—110 volt AC. Capacitor type. Sleeve bearing—⅝" shaft. List price $29.50. **Stock # 540.** A real buy at..... **$16.50**

★ WESTINGHOUSE

3 phase motors. All models ½ HP to 1½ HP. 220 volts. Motors totally enclosed—ball bearing. **Stock #541** 40% off list prices.

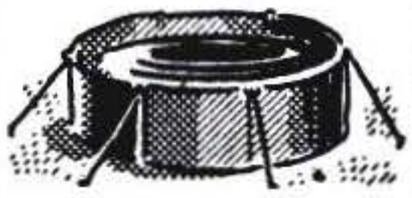
★ CLUTCH

For motor scooters, Motor bikes, lawnmowers, etc. Mercury centrifugal clutch for use with any small gas engine. (a) Belt pulley. ⅝" bore, brand new. **Stock #400.** only..... **$9.95**

★ CHIMES OR CALL SYSTEM

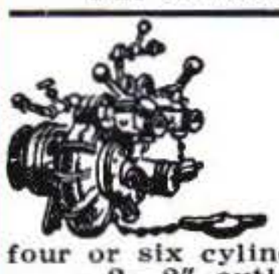
110 volt AC or DC. Weather proof. Navy type. List price $15.00. Super value at..... **$2.95**

★ Swimming or Bathing Pool



Made of heavy glass cloth with rubber impregnated on both sides 12' diameter, 5' high. 3000 gal. cap. Ideal for: small irrigation project, swimming pool, animal watering. Complete with cover & guide lines. Gov. price appx. $350. Our price..... **$79.50**
Due to handling remit full amount.

★ HALES FIRE PUMP



For fire deps., factories, forest fire prevention, etc. 600 gal. per min. Can be operated with a four or six cylinder gas engine. 4½" intake . . . 2—2" outlets . . . 265' head at 120 lbs. pressure. Passed by national board of fire underwriters. NEW. **Stock #407.** Price..... **$139.50**

Briggs-Stratton ★ GAS ENGINES

SAVE $25 ON LIST PRICE

All are NEW in original crate. Rope start. 1700 RPM all brand new and guaranteed. 1¾ to 2½ HP Model AP. List price $102.10. **Stock #307.** Our price.. **$77.00**
3½ HP Model BP. List price $111.50. **Stock #308.** Our price..... **$86.00**
5 to 7 HP Model ZZP. List price $137.00. **Stock #309.** Our price..... **$102.00**

★ GAS ENGINE

1 HP—2 cycle—NATIONALLY KNOWN—gas engines—3400 RPM—shaft ⅝" lightweight—12 lbs. List price $72.00. **Stock #537.** Our price..... **$44.50**

★ GENERATORS & AC ARMY Light Plants

All new unless specified. All 110 volt 60 cycle unless specified.
300 watt, 110-220 volt AC, 60 cycle light plant powered by 1 HP gas engine, direct drive. Mounted on base weighs 40 lbs. **Stock #409**..... **$99.50**
500 watt. Onan direct connected. **Stock #414.** NEW.. **$149.50**
NEW 1000 watt Briggs & Stratton belt driven Leland generator. **Stock #351**..... **$189.50**
NEW 1500 watt with Briggs & Stratton belt driven Leland generator. **Stock #352**..... **$209.50**
2500 watt. Briggs & Stratton Model Z and Leland generator. **Stock #317.** Used but like new..... **$225.00**
NEW tools and spare parts included **$295.00**
5000 watt, automatic remote control. Powered by 4 cyl. Jeep gas engine. Used like new. **Stock #318**.. **$575.00**
7500 watt, powered by a VE 4 Wisconsin 4 cyl. gas engine. Continental or Hollingsworth generator. Remote control starting. Complete with switchboard. Used but like new. **Stock #347**..... **$675.00**
Add **$65.00** for transformer to make this plant 3 phase 220 volt.
10,000 watt, 110-220 volt AC, 60 cycle. Remote control. Powered by a Jeep 4 cyl. gas engine. Used like new. **Stock #319**..... **$900.00**
NEW job original crate only **$1100.00**
25,000 watt 220 volt AC, 3 phase. Spare parts. NEW packed for export. **Stock #415**..... **$1995.00**

GENERATORS

300 watt, 12 volt DC, 2000 RPM. Heavy duty with current cut out relay. High and low switch. 30 amp. meter. Can be bought less shaft and base to be used directly mounted to a Briggs & Stratton 1 HP engine. **Stock #323.** NEW only..... **$7.00**
Complete with shaft base and bearing. **Stock #324**..... **$15.95**
300 watt, 110-220 volt AC, generator. Mfg. by Electric Specialties Co. Weighs 20 lbs. **Stock #416.** NEW only..... **$34.50**
1000 watt, 110 volt AC, 60 cycle generator with built in radio filter. Leland ball bearing 1800 RPM. **Stock #526**..... **$89.50**
1500 watt. Same as above. **Stock #527**..... **$99.50**
2500 to 3000 watt, Leland generator 110 volt 60 cycle. Self excitor, radio filter, junction box for plug in. **Stock #525.** NEW..... **$145.00**
3000 watt, Delco. 110 volt DC. Plug in, ball bearing 2800 RPM. List price $343.00. Used but like new. **Stock #321**..... **$99.50**

★ WESTINGHOUSE TRANSFORMERS

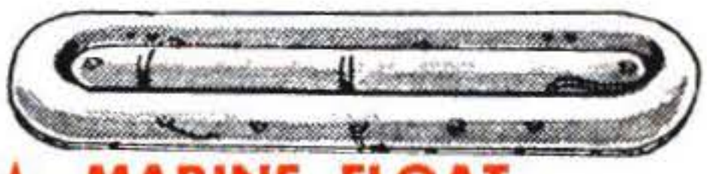
Dry type—insulated—440 volt, 220 volt to 110 volt—single phase.
75 K.V.A. List price $1009.00. Our price..... **$504.00**
37½ K.V.A. List price $717.00. Our price..... **$358.00**
30 K.V.A. List price $626.00. Our price..... **$310.00**
25 K.V.A. List price $558.00. Our price..... **$279.00**
20 K.V.A. List price $460.00. Our price..... **$230.00**
All like new and guaranteed.

★ HEAVY DUTY ELECTRIC CABLE

3 wire #10 Super cable. **Stock #351.** 65' with lugs. Value $26.00. Our price..... **$13.00**
3 wire #10 government submarine type. Used underground, underwater, overhead. Cost U. S. 90c ft. **Stock #542.**
Our price 100 ft..... $24.00
" " 250 ft..... $55.00
" " 500 ft..... $100.00
" " 2900 ft. reel..... $530.00
2 conductor rubber cable #4—stranded—75 ft. length with connectors. List price $177. **Stock #543.** Our price..... **$90.00**
4 wire #6 stranded heavy duty. List price $2.36 per ft. **Stock #548.**
Our price 50 ft..... $30.00
" " 100 ft..... $55.00
" " 250 ft..... $125.00
" " 500 ft..... $225.00
" " 1000 ft. reel..... $400.00

★ AIR COMPRESSORS

All ratings from ⅓ HP to 10 HP—new and rebuilt. Write for free details.



★ MARINE FLOAT

Heavy rubberized fabric. ½" rope encircles raft passing through dee rings as handles. Can be used as wading pool, dock, raft, etc. Will support 4 ton and cannot tip. Used but like new. **6' W x 25' L $69.50** **6' W x 20' L $59.50**
50% deposit to handle shipping.

★ HORNS AND HOWLERS

Motor driven. (not a vibrator). Heavy duty with great power and long life. Adjustable for high, medium, or low tone. 110 volt AC current. Weather proof. For alarm or signal horn on boats, school yards, factories, etc. List price $47.00. NEW. **Stock #302.** Our price.... **$9.45**

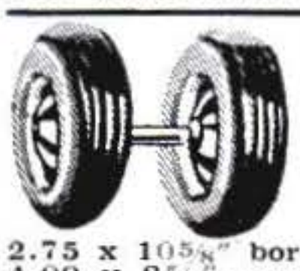
★ HALF TON WAGON

Half ton wagon with plate aluminum body 24" x 42", ⅝" steel axle. **Stock #332.** Write for details.

★ HOSE 20' LENGTHS

Gas, oil or water resistant. Neoprene treated 1¼". Male & female brass connectors. Standard filling station size. Value $20.00. **Stock #528.** Our price.. **$7.50**
Foot valve..... **$3.00**

★ RUBBER WHEELS



Good for boats, scooters, wheelbarrows, etc. **Stock #536.**
2.75 x 10⅝" bore..... $4.50
4.00 x 8⅝"..... $10.95
10½ x 4, 6 ply ⅝"..... $8.95
14½ x 5, 6 ply 1"..... $10.95
NEW airplane tires, tubes and wheels with high speed Timken Hyatt ball bearings. 800 x 5, 6 ply 1". **Stock #544**.... $14.50
1700 x 20" 12 ply tubes for earthmovers, trucks. $83.00 value—**Stock #545**—price..... $44.50
56" 16 ply Bomber tires and tubes. $600 value. **Stock #546.** price..... $59.50

★ STAINLESS STEEL TABLE TOPS

Polished top, dull bottom, hardwood veneer center ¾" thick. Ideal for: work table, laundry tubs, shelves, back bar work board, etc. **Stock #411.**

22 x 19½"	11 lb.	$1.95
22 x 21½"	12 lb.	$1.95
23½ x 27"	15 lb.	$2.45
22 x 29½"	16 lb.	$2.95
22 x 34"	20 lb.	$3.45
22 x 37"	22 lb.	$3.95

★ BALL BEARING ARBORS

Grinding and saw arbor, has ½" double end shaft, 11½" long with 2" center pulley. New Departure double roll ball bearings. Right and left hand thread. Self aligning Dodge pillow block 10,000 RPM. Bearings alone list at $10. Complete arbor. NEW. **Stock #305**..... Only **$4.95**
HI-SPEED GRINDER (not pictured) has two step pulley driven thru rear or base. **Stock #328**..... **Only $10.95**

★ PLASTIC TUBING

Good for water, oil, air, electrical installations & radio work. Available in 100 ft. lengths. Min. order 50 ft.
⅛", 3/16", ¼", (your choice) per ft..... 2c
5/16" per ft..... 3c
9/16" per ft..... 4c
¾", 1", (your choice) per ft..... 6c
1⅜" per ft..... 8c

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C & H ELECTRIC Co.

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MILWAUKEE 3, WISCONSIN

All prices F.O.B. Milwaukee. 25% deposit required on all C.O.D. orders. No C.O.D.'s under $10.00. Use stock number when ordering. Many other bargain items not listed—write for our free circulars.

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AUTOSEAT

SEAT COVERS

CHOICE OF PLAID OR SOLID PATTERNS

Brighten up your car—any model, any make—with these handsome AUTOSEAT Seat Covers at a NEW LOW PRICE because you buy DIRECT FROM THE MANUFACTURER at a tremendous saving. Sturdily constructed for durability, coated with vinyl plastic to eliminate snagging and for longer wear, double-stitched for extra strength, snug fitting all around. Easy to install—do it yourself! Cover worn upholstery, protect new, with AUTOSEAT covers at this direct-from-us low price—save the difference! Send us your order now! 5-day money-back guarantee!

EASY TO INSTALL

SET COMPLETE ONLY $9.95 POSTPAID

FOR ANY CAR, ANY TYPE SEAT!

1 Solid back **2** Divided back and solid seat **3** Divided back, divided seat **4** Divided back with armrest $1.00 extra

5-DAY MONEY-BACK GUARANTEE

AUTOSEAT COMPANY
P. O. Box 1032, HUNTINGTON 13, W. VA.

Gentlemen: Rush AUTOSEAT seat covers on 5-day money-back guarantee as follows:

☐ Complete front and back $9.95.
☐ Front seat cover only $5.45.
☐ 3-pass. divided back coupe $5.45.
☐ 3-pass. solid back coupe or coach or sedan $4.45.

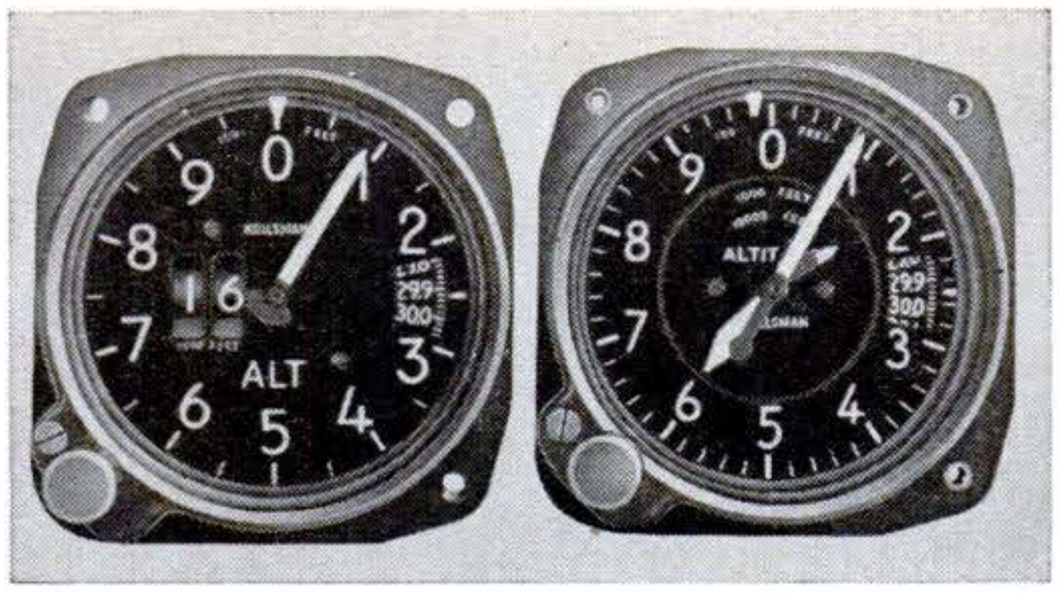
My car is a 19__ (Make)_____ (Model)_____

I have checked pattern and style desired:

☐ Plaid ☐ Solid (1) (2) (3) (4) ($1.00 extra)

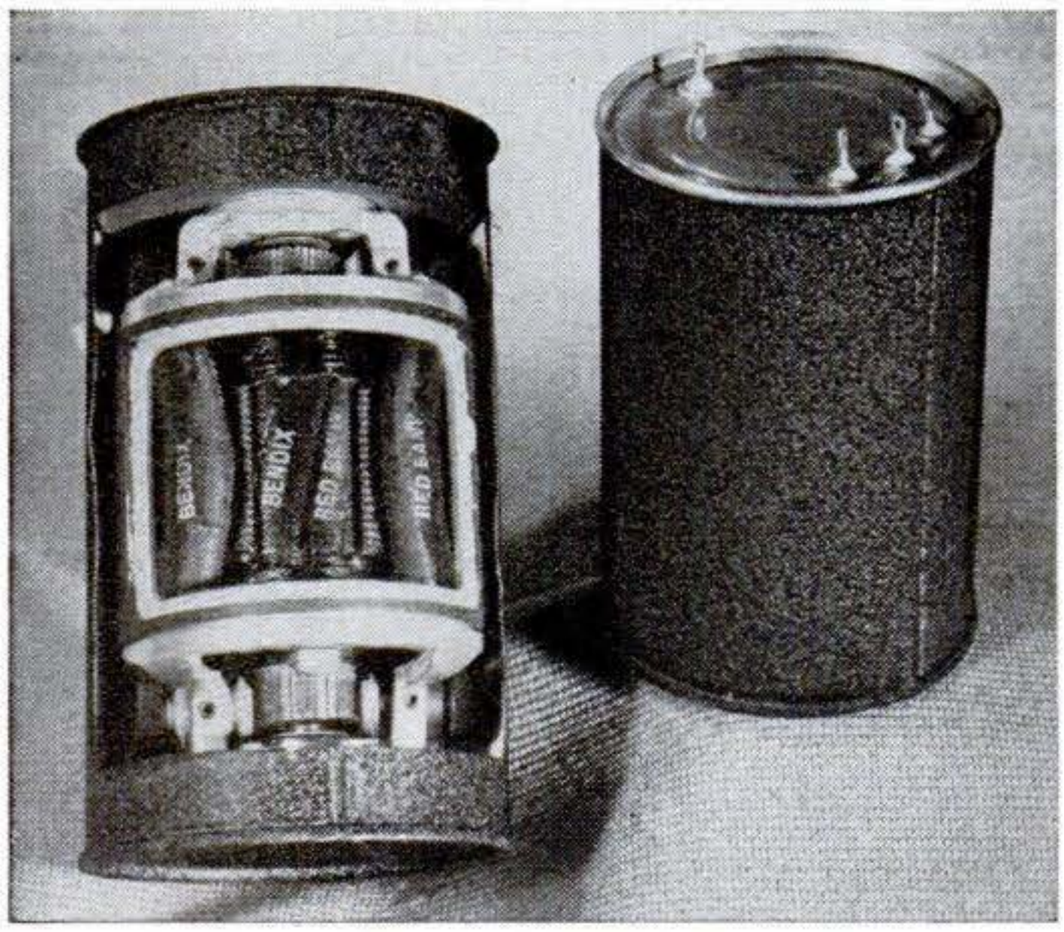
Rush postpaid. Enclosed is $ _____
(In W. Va. add 2% Consumers' Sales Tax)

Name _____
Address _____
City_____ Zone____ State_____



Altimeter Is Simplified

PILOTS can read their altitude faster, easier, and with less chance of error with the new altimeter at left above. Called the Kollsman 160®, it has a two-digit counter that shows altitude directly in thousands of feet, while a single sweep hand marks off additional altitude in 50-foot graduations. With the old-type altimeter, at right, it takes three hands—and some careful figuring—to get the same reading. To make possible the new indicator, engineers had to develop a lightweight cylinder counter that requires 20 times less torque to turn it than any existing counter.



Canning a Dynamotor

THE tin cans above don't hold food, but they're the same kind that do. They contain tiny dynamotors, used to operate electrical equipment in airplanes. The dynamotors are hermetically sealed in the cans at sea-level pressure to keep them operating efficiently at high altitudes where reduced pressures would tend to throw them off. When repairs are needed, they can be opened with a ordinary can opener, then resealed in fresh cans. Bendix Aviation developed the method, and American Can supplies the containers.

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Your Vacation Land!

HARLEY-DAVIDSON
WITH THE NEW
HYDRA-GLIDE FORK

See America the scenic, fun-packed way — on a Harley-Davidson Hydra-Glide Motorcycle. You'll enjoy a new kind of vacation — a thrill-packed tour with picturesque back-country roads, breath-taking mountain trails, hidden lakes and quaint towns ever beckoning to new adventures and good times. You'll ride smoothly and comfortably, too — float along like a breeze! Even on longest trips, you'll hardly know you've been traveling — you're fresh as a daisy and ready for more fun! One ride will convince you. See your dealer. Mail coupon today.

HARLEY-DAVIDSON MOTOR CO.
Dept. PS, Milwaukee 1, Wisconsin

Send *free* copy of ENTHUSIAST Magazine filled with motorcycle action pictures and stories; also literature on latest models.

Name.....

Street or R.F.D.....

City.....Zone..... State.....

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How white

should a white shirt be?

Only as white as it looks; certainly not an over-exposed wash-out without texture. With a WESTON Exposure Meter you get the exactly *right* exposure every time. It instantly gives correct camera settings for any camera, any film—including color. See it at leading photo dealers everywhere.

WESTON *Exposure Meters*

Master II

The meter most photographers use!

FASTEST PLANER in the WORLD at this Low Price ... $215.00

BELSAW Multi-Duty Planer

Speed up production! Increase your profits! BELSAW power self-feeds at 24 feet per minute...The lowest-priced surfacer that will handle 12 x 6 in. stock. Planes green or dry sawed lumber into smooth, worked forms. Three high-speed steel knives make 42 cuts per inch. Multi-duty BELSAW takes inexpensive attachments for all planing mill operations — Jointing, Rabbeting, Grooving, Matching. BELSAW is the ***only*** 12 in. planer providing ***attachments for jointing and grinding its own knives.*** Start planning NOW for BIGGER VALUE and BETTER PERFORMANCE, with BELSAW. Write for FREE specifications, illustrations and low prices.

● LARGER CAPACITY ● FASTER OUTPUT ● KNIFE SHARPENING ATTACHMENT

BELSAW MACHINERY CO B-1027 Field Bldg., 315 Westport Rd., Kansas City, Mo.

SAVE UP TO 20% on QUALITY BALL BEARING POWER MOWER ATTACHMENTS

Build your own power mower with our spindle and blade attachment. Pully for easy connection with engine. Sealed in New Departure Ball-Bearing for lifetime service. 20 or 18 inch blade of tempered steel with razor sharp cutting edge. Read guarantee — you'll order now and enjoy an easy power mower.

Attachment for gasoline power mower, complete (designate 20 or 18 inch blade)...$14.95

Replacement blade (designate 20 or 18 inch blade) $1.25

GUARANTEE: No better products are made regardless of price; 10-day return privilege.

SAVE UP TO 25% ON BALL-BEARING WHEELS

Ball-Bearing Replacement Wheels (For ½ Inch Axles)
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BILT-RITE PRODUCTS CO.
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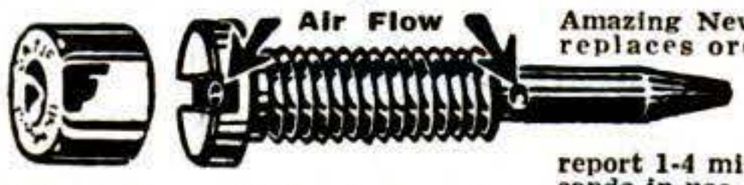
SAVE GAS • get 1 to 4 EXTRA miles per gal.



Amazing New GANE Air-Flow needle replaces ordinary idle adjustment screw in your carburetor. SAVES GAS. Faster pickup, Easier starting, perfect idling. Owners report 1-4 miles more per gallon. Thousands in use. *10-Day Money-Back guarantee.* Quickly installed on cars & trucks. *Order yours Today!* Complete with instructions. $1.50 ea.

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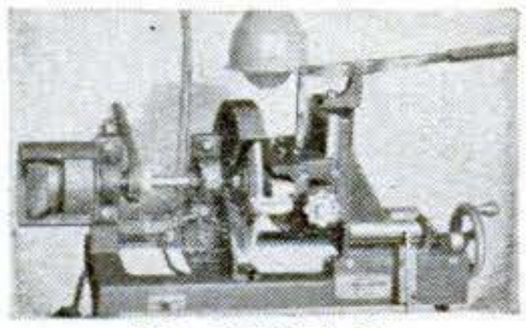
Cameron Mfg. Co. 539 E. ADAM ST. .. DEPT. PS-749 PHOENIX, ARIZONA



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Recovers Power Between Uses— Bounces Back for Extra Life!

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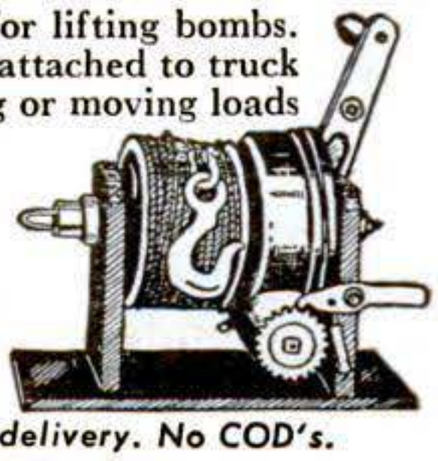
Originally made to be used on B-29s for lifting bombs. Mounted on welded steel base, can be attached to truck body or any solid base. Ideal for lifting or moving loads onto trailers, trucks or tractors or for machine shops, garages or warehouses. Capacity 2,000 lbs. Equipped with ratchet for holding load and 18 ft. ⅜" steel cable. Shipping weight 50 lbs. FOB, Kansas City, Mo. **$29.95**



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LOGAN HEAVY DUTY
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BRAND NEW control valve with built-in adjustable relief valve, will operate one double-acting hydraulic cylinder or 2 cylinders as one or a reversible hydraulic motor. Valve handle latches in neutral position. Made of rugged cast aluminum alloy. Open center unloads the pump in neutral position. Throttling control allows operator to regulate the speed of movement of the hydraulic cylinder or motor. Has removable mounting brackets with 4 bolt holes, 3/8" pipe thread connections. Overall dimen.: 12½" H x 8½" D x 8" W. Ship. wt. 17 lbs. AN EXCELLENT BUY FOR..... **$21.95**
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8" Sealed Beam FLOODLIGHTS

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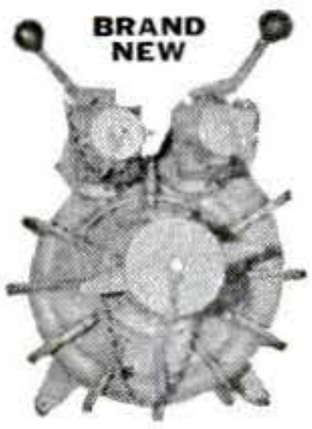
HIGH VOLUME CENTRIFUGAL PUMP



For Fire Protection, Irrigation, De-Watering, Industrial Uses, Farm Uses, etc.
PUMPS RATED 500 GALLONS PER MINUTE AT 275 FT. HEAD PRESSURE.
Equipped with 1½" diameter straight splined shaft for direct coupling drive; 4½" threaded suction intake; two–2½" threaded discharge outlets; Hale Pump Co. Model CF volute type. Use any 4 or 6 cylinder gas engine or couple directly to front of truck or auto; or use 25 H.P. electric motor. Dimension 21" x 24" x 28". Complete with full accessory kit including suction and pressure gauges, priming equipment, and instruction book. Shipping wt. 415 lbs. **Gov't acquisition cost $425.00. NOW**..... **$149.50** F.O.B. Chicago

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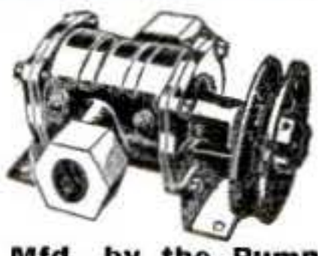

POSITIVE PUMPING PRESSURE
Perfect for draining basements, irrigation, fire fighting, sprinkling, pressure booster, insecticide and other spraying, fuel transfer, stock watering, industrial pumping, deep well jet pumping and home water systems. Rated 25 ft. suction and 150 ft. head pressure at 80 gallons. Use from 1/3 to 5 H. P. motor.

Mfd. by the Pump Division Eaton Mfg. Co.

COMPLETE ENGINEERING REPORT AND INSTRUCTIONS FREE WITH PUMP
Supplied with mounting brackets and 5" V belt pulley, ready for instant use. Standard 1½" pipe thread inlet and outlet. Dimensions: 9½" x 7¼" x 4¼". Ship. wt. 18 lbs. A $142.00 value..... F.O.B. Chicago **$32.50**

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Use them to spring suspend vehicles, hoists, pumps, heavy and light machinery, compressors, etc. 11" x 2" dia. Welded steel construction for extra strength–U. S. Air Force bought them for bomber gas tank shock absorbers. Rated 2500 lb. Ship. wt. of 4–11 lbs.—**4 for $5.00. Each $1.50 F.O.B. Chicago.**

BRAND NEW AIR OR OIL
HYDRAULICS

Use hydraulics on arbor presses, hydraulic presses, hay lifts, manure loaders, lift trucks—push or pull, tilt or turn, press or squeeze, open or close, lift or lower—and other hydraulic and industrial applications. Use with either air or oil . . . of finest precision workmanship.

1. Double action, 1" bore, 3" stroke, will lift 770 lbs. in 1/10 of a second using Logan Pump. All steel barrel. Ideal for controls, door openers, positioning, etc. An $18.00 value ..... postpaid **$4.95**

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4. Use these cylinders on farm trucks, bulldozers, hay lifts, manure loaders, etc. Double action, 1½" bore, 27" stroke. (Will lift 1760 lbs. in 2 seconds with Logan Pump. Wt. 8 lbs. A $55 hydraulic cylinder value for only.....postpaid **$12.95**

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Hi-pressure fittings for cylinders and valves available at 35c ea. for 3/8" pipe and 50c ea. for 1/2" pipe.

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Hydraulic Control Valves

1. Four-way control valve for use with double action hydraulic cylinder, may be used with 1500 P.S.I. hydraulic system to open and close hydraulic cylinders. Brand new. Ship. wt. 4 lbs. A $38.00 value.....postpaid **$7.95**

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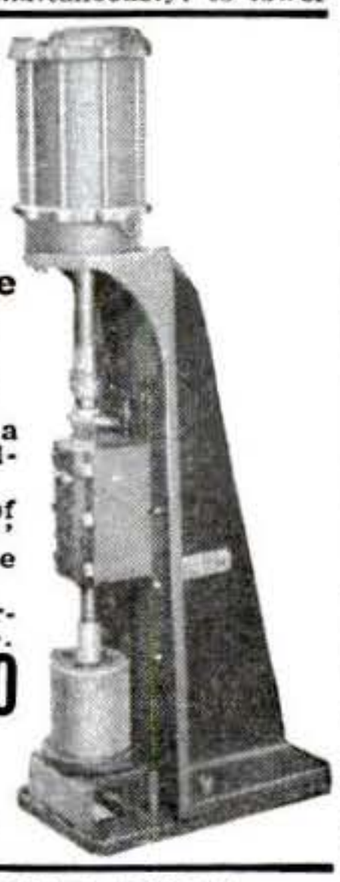
Brand New Double-Action Pneumatic-Hydraulic
PRESS

$300.00 value offered at a fraction of original cost



Using air or oil, this device is ideal as a punch press, vise, arbor press, etc. An excellent tool for industrial and shop use.

Use 150 lbs. of air pressure or 250 lbs. of oil pressure. Cushioned double action "Logan" Model AC ram, 6" bore and 6" stroke. Capable of up to 4200 lbs. of pressure using air.

Has 3" throat. Lubricated gibs provide perfect alignment. Has adjustable work space. Hardened alloy steel piston rod 1" diameter. Frame constructed of cast steel with 3/4" base plate. Manufactured by Sipp-Eastwood Co. Unit is 49" high. Base is 9½" wide by 18" deep. Wt. approx. 300 lbs. AN OUTSTANDING BUY at..... **$79.50** F.O.B. Chicago

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All Manganese Bronze for spraying D.D.T., 2-4D, Sulphur Compounds, Etc. Pressure up to 150 lbs to 14 gallons per minute–1500 RPM. Will not rust, pit, foul or freeze up. Use rubber hose inlet, pipe or tubing outlet. Equipped with 1/2" standard pipe thread port. Wt. 10 lbs. Dimen.: 8" x 5" x 6½". Standard 1" manganese bronze shaft with keyway. U. S. Gov't. Acquisition Cost $62.00. **Now Only** . F.O.B. Chicago **$15.00**

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Authorities say bicycles are built for top speed of not over 25 mph. Ride in Safety—and Go Ten Miles for a Cent. Students, shop and office workers: savings on car and bus fares soon pay low cost of TRAVIS "Bike" Motor.

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she's some *SMOOTHIE!*

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1949 line features many new models offering increased performance and greatly simplified instructions. Low prices! 8 ft. Dinghy $34.50, 16 ft. Runabout $159. Dinghies, Skiffs, fishing and speed boats for the home builder.

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Only the simplest tools are required. Simplified building instructions. Precision cut parts.

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Chrome plated, precision engineered and carefully tooled to give long life. All new.

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1-2" capacity . . . each **3.50**
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This 12" high, precision drill press is ideal for model making, wood carving, routing, etc. Utilizes No. 2 Moto-Tool. **Only $9.95 (Less Moto-Tool).**

Look For These Moto-Tool Features

Dynamically balanced armature for vibrationless finger-tip control ● Oilless (oil-sealed) bearings ● Patented automatic chuck lock pin ● Over-size armature shaft—hardened, ground, polished ● 110 Volt AC-DC motor ● Snap-type sliding switch ● Cord protector ● Shockproof bakelite housing ● Dust-filtered air-cooling system ● Weighs only 13 oz.

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Makes Fun of Hard Work

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Say "Good-bye" To Hand Sanding & Polishing!

Let speedy **"Moto-Sander"** do the work while **you** just guide it. Ideal for light sanding jobs. Use **Moto-Sander** for finishing, refinishing, redecorating. Quickly and smoothly sands furniture, walls, woodwork, wall board, plaster joints; boats, workshop projects, etc. **Straight-line action (non-rotary) will not burn or scratch surface.** Use **Moto-Sander** also for fast, effortless **polishing** of furniture, refrigerator cabinets, automobiles, other waxed surfaces. This versatile machine works on flat or curved surfaces—gets into tight corners. **Moto-Sander** is the lightest, most practical electric sander on the market. Delivers 7,200 strokes a minute . . . weighs only 2½ lbs. Furnished complete with 6 sheets assorted grade Garnet Paper for sanding, plus **felt pad** and **sheepskin** for wax polishing. Operates on 110-120 V., 60 cycle A. C. Thousands of satisfied users.

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AN *Electric* SCROLL SAW

SAFER THAN A HAND SAW

A high-speed power saw for boys from 8 to 80! **Moto-Saw's** 7,200 strokes a minute easily cuts intricate scroll designs—no limit to length of cut—averages 1 foot per minute through medium hardwood up to ¾" thick. **Four-way blade holder** permits sawing in any direction . . . at any angle. **Moto-Saw** has only 2 moving parts—never needs oiling. Operates on 110-120 V., 60 cycle A.C. Thousands of satisfied users.

ONLY $5.85 POSTPAID

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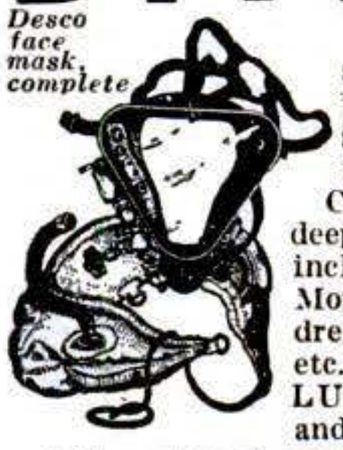

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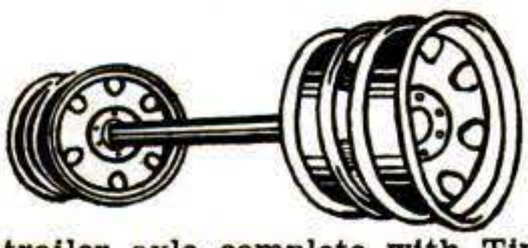
TRAILER AXLE



Heavy duty trailer axle suitable for many types of trailer construction. Also excellent for building of heavy farm trailers and wagons. It is a 12,000 lb. capacity square type straight trailer axle complete with Timken roller bearings, hubs, and 6 hole 750 x 20 Budd Wheels. Without brakes. Axle is 2 inches square and 69 inches between wheel mounting flanges. Std. width. AN EXCELLENT BUY.

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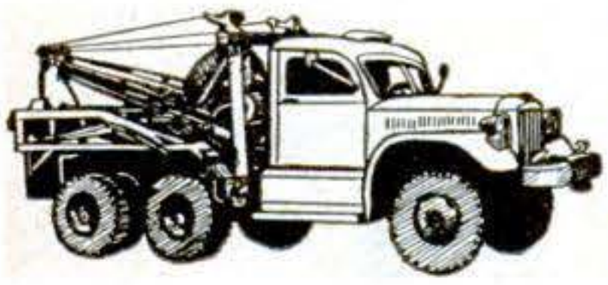

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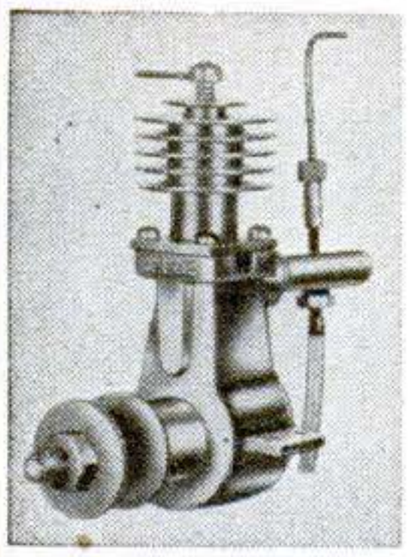

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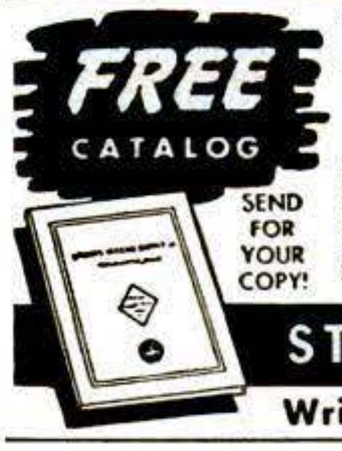

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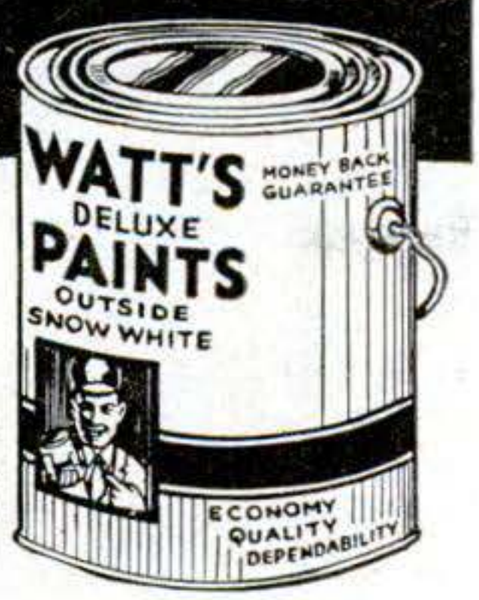

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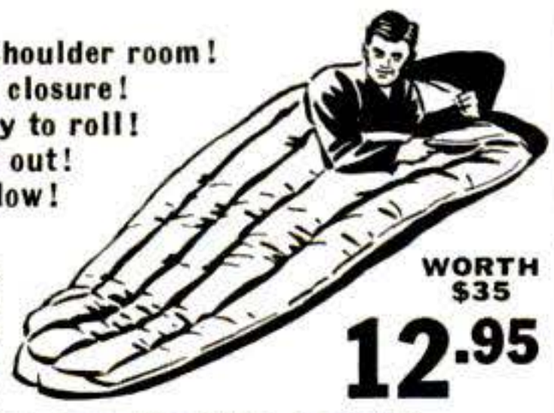

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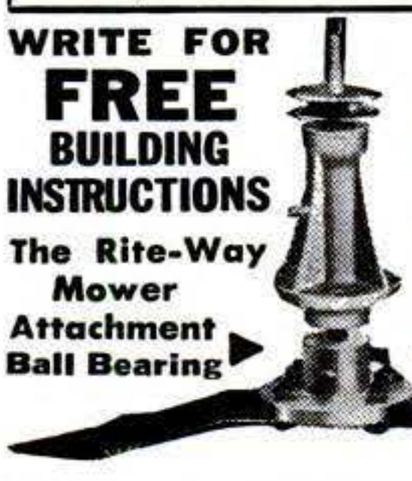

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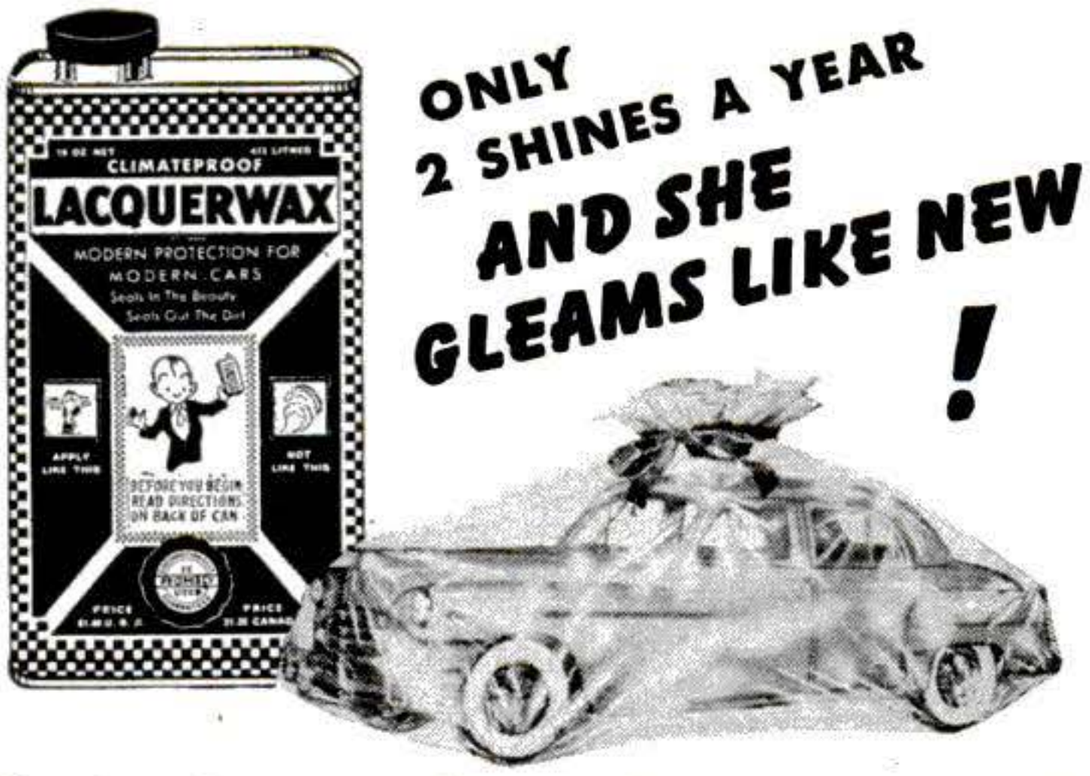

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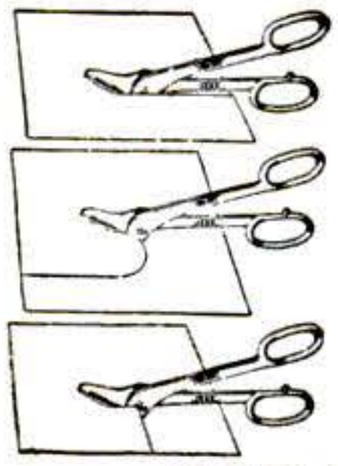

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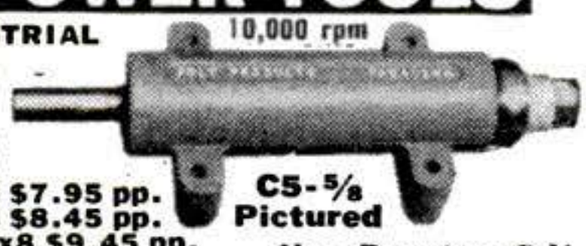

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110V, AC 50-60 cycles, cont. duty motor, deliver app. 100 C.F.M. For workshop, lab, kitchen, cellar, etc. Install yourself. Send for circular.

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THE BULL BUFFER

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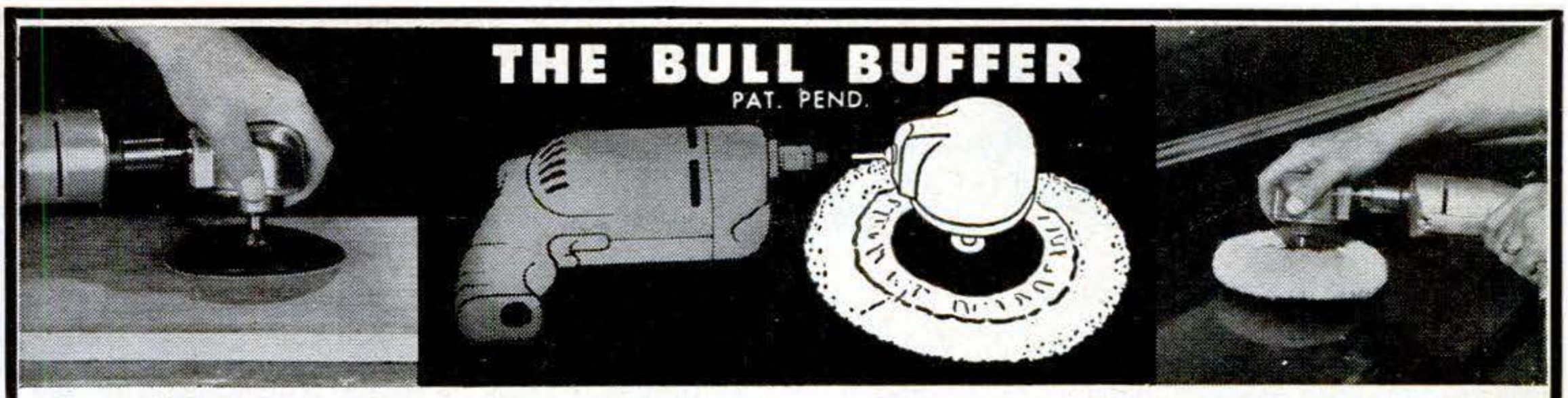

You polish and sand faster, easier—do beautiful, *professional* work—with this amazing new attachment for your hand drill. And it more than pays for itself *the very first time* you polish and sand your car, floors, woodwork, furniture.

The Bull Buffer fits any chuck on an electric drill (or flexible shaft). It's the only buffer you can turn *in a complete circle* while you hold your hand drill stationary. Reaches all curved and flat surfaces. It's packed with power, built of lifetime materials and *guaranteed*.

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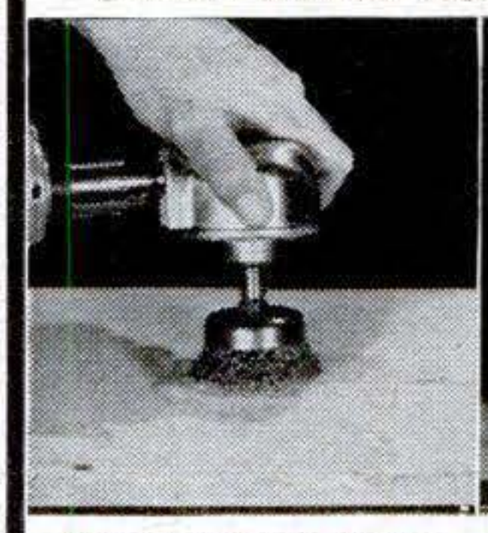

Cup wire brush attachment for removing paint, rust, scale, etc. **$1.75**

Jacobs key chuck: When attached to Bull Buffer, increases 1/4" drill to 1/2" capacity—reduces speed, increases power. **$5.00**

- Bull Buffer car cleaner ..... **$ .50**
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- Extra sanding discs (0000-00-0-1-2 1/2-3) Each 10c
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Bull Buffer comes complete with 5-inch rubber disc, sheepskin bonnet, and 2 sanding discs, only **$9.95.**

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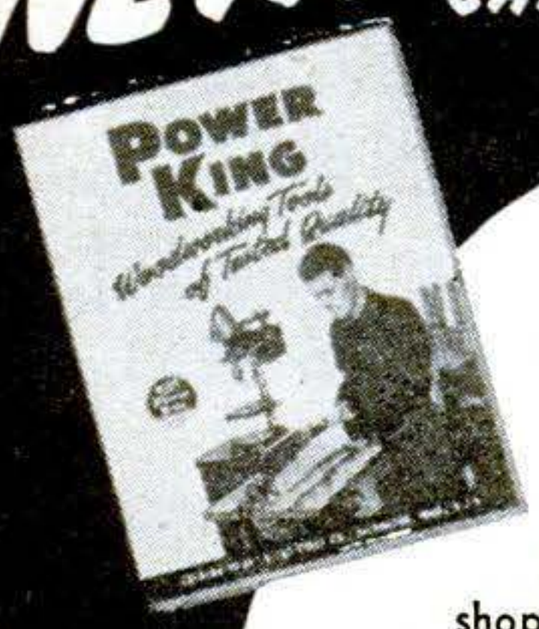

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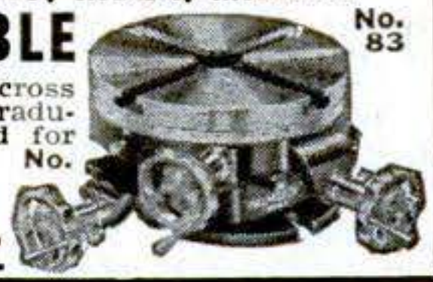

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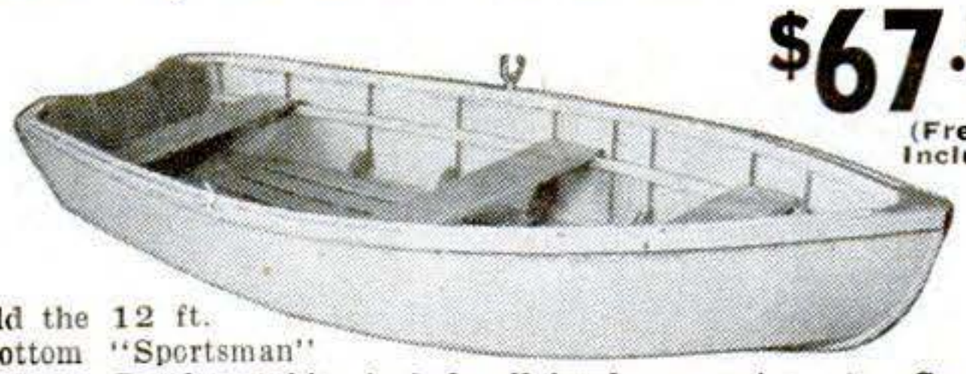

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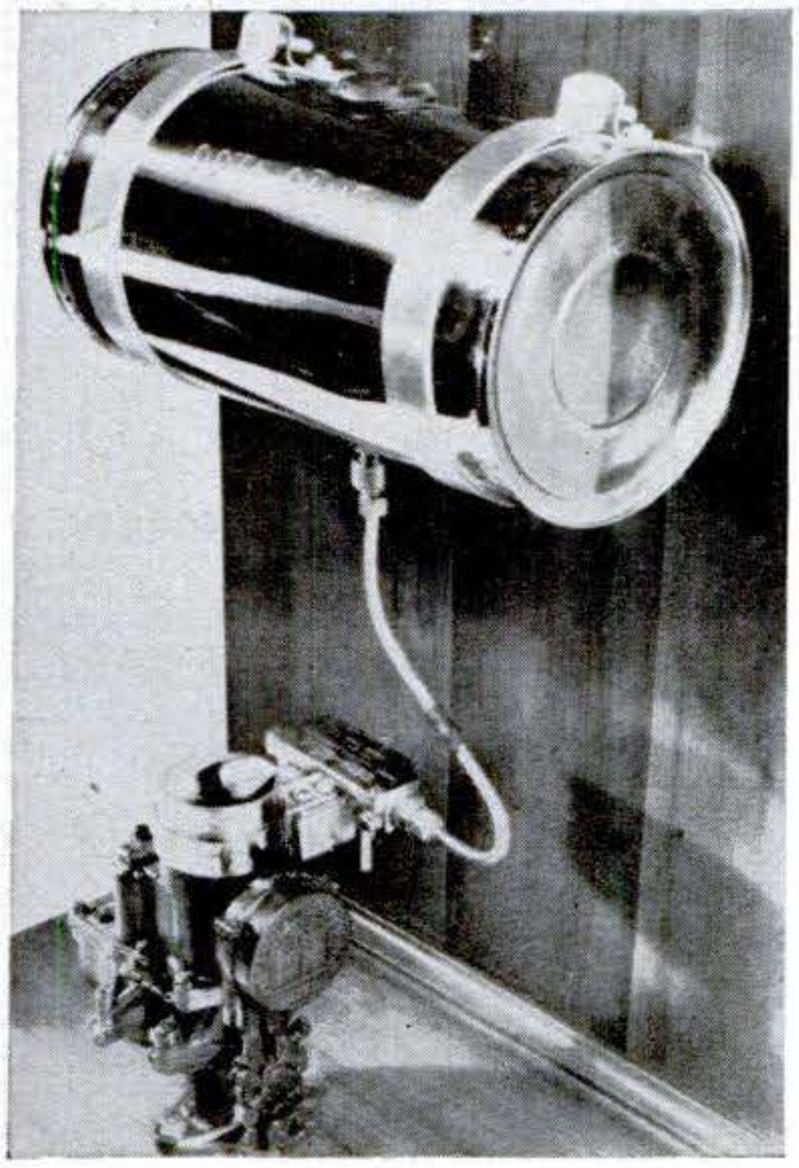

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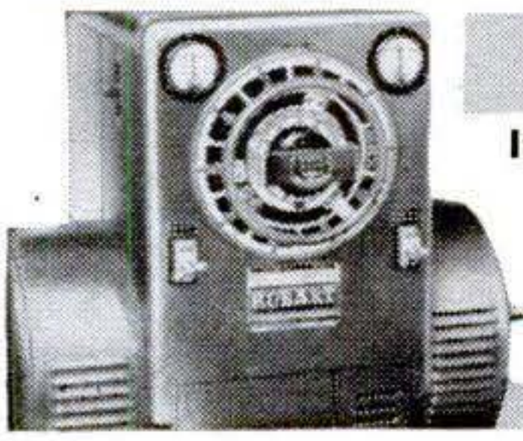

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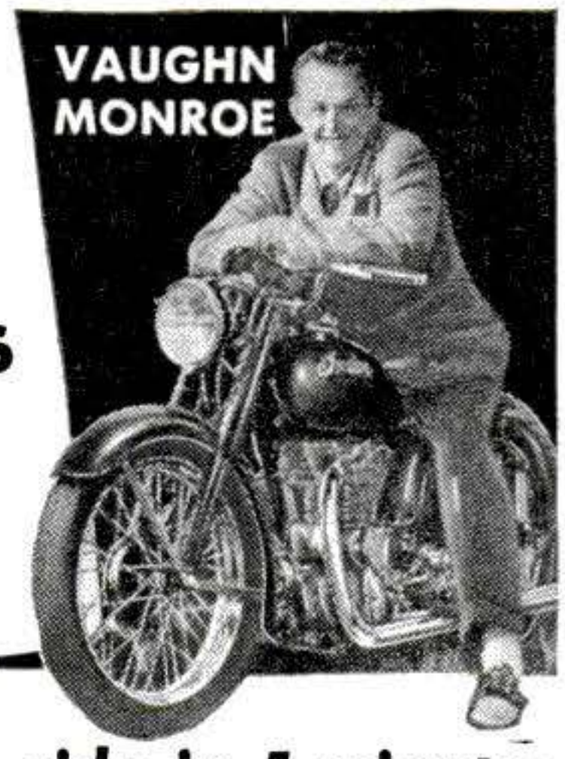

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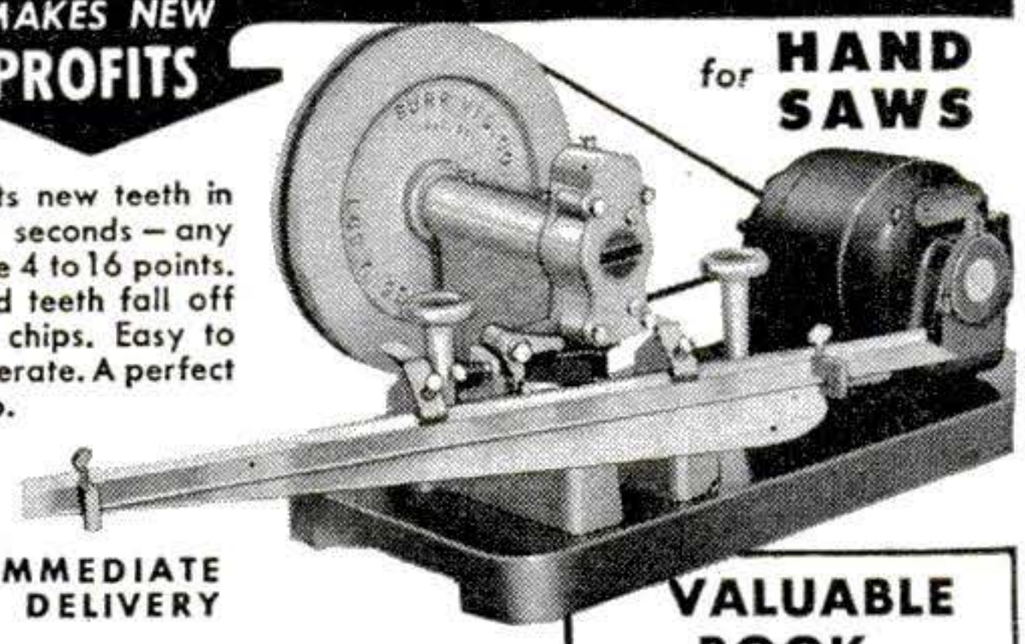

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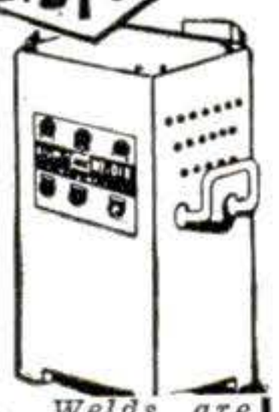

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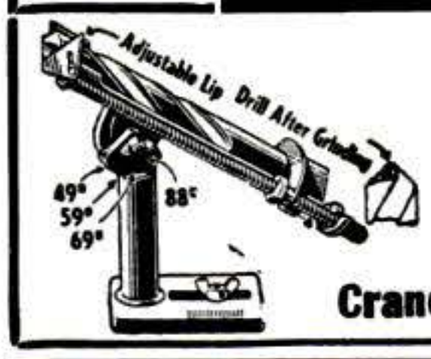

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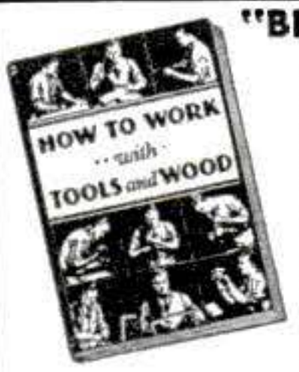

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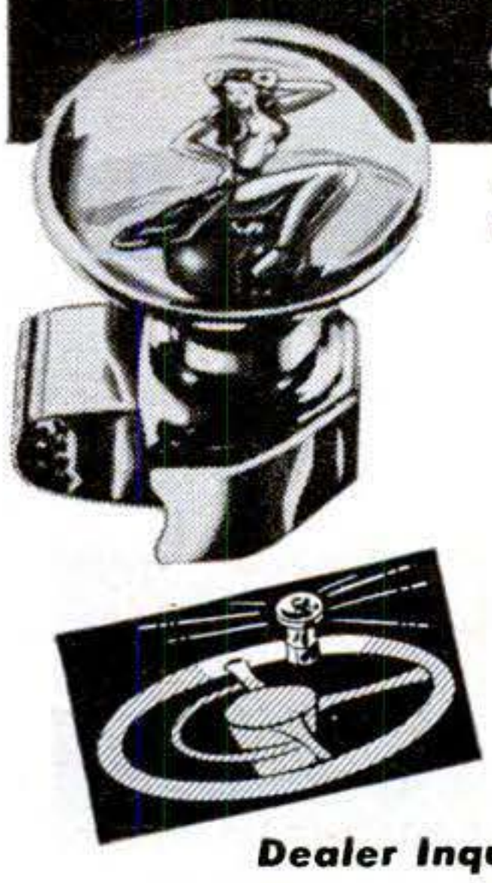

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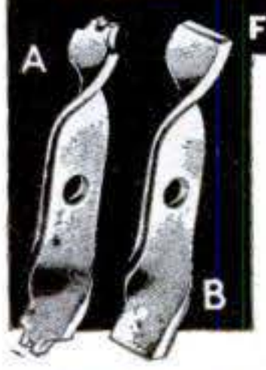

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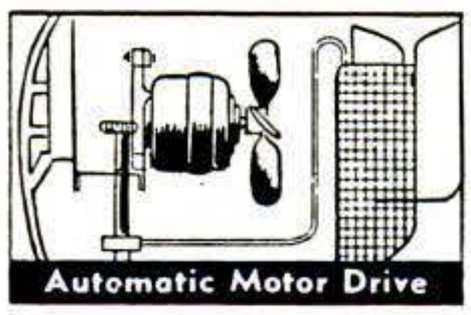
MOVING OR PARKED

Winter Breeze

Styled for the Modern Car

ELECTRICALLY DRIVEN CAR COOLER



WINTER BREEZE provides cool, fresh air whether car is standing still, moving fast or slowly. Powerful 3200 r.p.m. motor operates pump, fan and specially designed filter that purifies and circulates cool air to every part of car. No ropes or chains to pull. No manual effort of any kind. WINTER BREEZE operates automatically . . . converting sizzling temperature to mountain coolness!

WINTER BREEZE does not mar or obstruct the view of the passengers.

WINTER BREEZE is supported by the metal door frame, not the glass. All points of contact are cushioned with top quality rubber mounting. WINTER BREEZE is adjustable to fit any size window. Won't mar car finish. Glass can be rolled all the way up and car locked.

WINTER BREEZE can be installed, or removed, in less than 5 minutes!

WINTER BREEZE Auto Coolers are guaranteed against defects in materials and workmanship for a period of 1 year—will last for years.

Neutral hammered metallic grey, or black prime undercoat. Specify. If your dealer is out, rush us $39.95 for WINTER BREEZE and we will ship via parcel post immediately! Guaranteed as advertised or money refunded.

Automotive Division Inc. Federal Identification Co.

1713-35 West Grand Ave. Dept. S Okla. City 6, Okla.

Please rush via mail one Winter Breeze Motorized Cooler in .....finish. I am enclosing $39.95 full prepaid price.

NAME.....

ADDRESS.....

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SANDEE

Mufflers—All Ford, Chev., Ply.....$4.45
All Buick, Pont., Olds., Chrys., Dodge, Hudson, K.F., Pack., etc.....$5.45
V-8 and Merc. Duals (32-49 incl.) $15.95

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DURABILITY

Beautiful SANDEE Fender Skirts $16.95

A SANDEE Sportone will outlast two ordinary mufflers and give More Power! More Speed! More Mileage!—plus a tone quality unsurpassed.

Please ship (item):_____Price_____
Car and Year_____Name_____
Address_____

SANDEE MUFFLER CO. 5643 Corryne Pl. Culver City, Calif.

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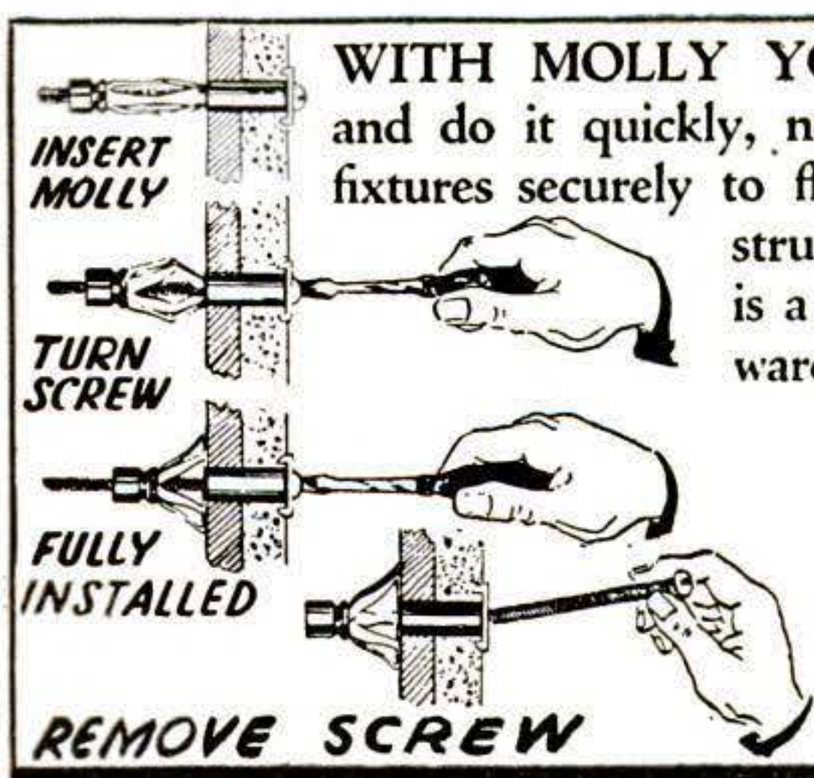

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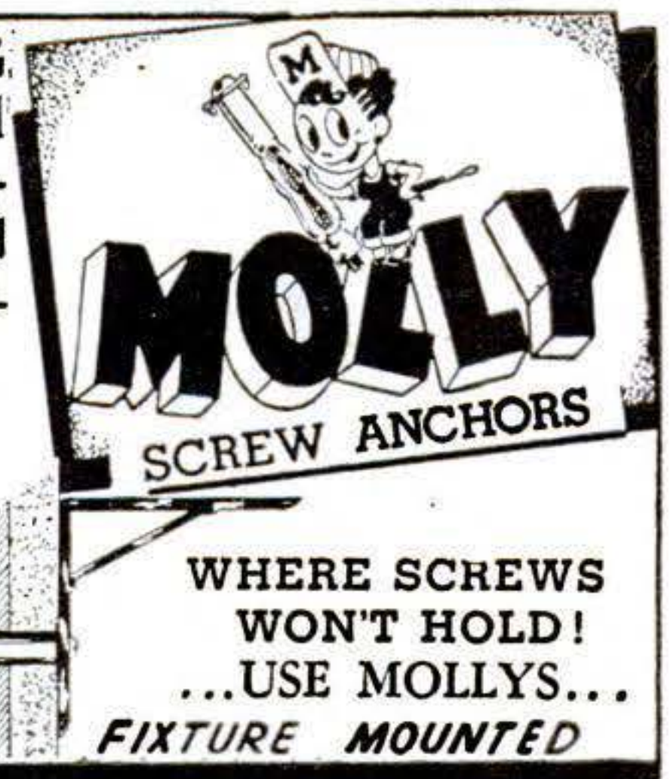

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BUILD YOUR OWN TILTING ARBOR SAW!

SAVE $50 OR MORE

- 27x28 in. table stays level. Blade tilts full 45 degrees.
- 10 in. blade cuts 3¼ in. deep, jack-screw depth adjustment.
- Floor model, 34 in. table height.
- New Departure ball bearing arbor, ¾ in. precision shaft, ready to run, ⅝ in. bore blades.
- Quick-positioning, self-aligning rip fence guide.
- Sturdy wood, steel and aluminum construction.
- No machining—build easily with hand tools only.
- Capacity and performance of floor saws selling for $150.00 and up!!

GIL-BILT Step-by-Step pictorial plans (No blue-print reading required), full scale patterns, 11 actual photographs $1.00
GIL-BILT Metal Parts Kit includes Plans, ball-bearing arbor, cast aluminum miter gauge and bar, rip fence guide, machined lock knobs, jackscrew mechanism with 4½ in. handwheel, and all other metal parts including every screw, bolt, nut and washer (less blade) $20.95
Same Kit with 10" combination blade 25.90
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Return in 10 days for full refund if not satisfied.
(Prices include postage up to 600 miles)

Also available—Plans and Metal Parts Kits for 8" Tilt/Table Saw and 12" Band Saw. Order Plans at $1.00 each—sent postpaid anywhere in the world, or write for FREE descriptive Catalog.

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3 MODELS—$99.00 up

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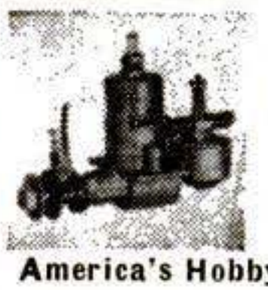

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A miniature gas engine that really operates. Thousands of Buzz "B" gasoline engines have been sold at twice the price. Now is your chance to buy a real 1/6th H.P. gas engine for only $4.95. Turns up over 8,000 rpm. For Boats, planes, midget cars, etc. Guaranteed and ready to run. Includes Champion spark plug and tank. Send only $1.00, engine shipped collect for balance, same day. Write for free catalog or **SEND 10c FOR NEW MAMMOTH ILLUSTRATED CATALOG OF THOUSANDS OF HOBBY ITEMS.**

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NEW! COMPLETE HOT ROD MANUAL

NEW! 128 page manual, chock full of cutaway construction drawings, photographs and valuable, easy to read and understandable technical data. A neatly bound manual with colorful eye-catching cover. Includes complete data on how to install V-8 engine in Model A chassis.

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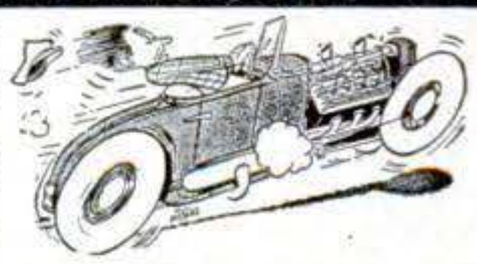

How to rework the following engines for speed and power: V-8, Merc, Ford 6, Zephyr, and Model A & B. Also includes data on column shifts, Zephyr gears, and how to install hydraulic brakes in any year Ford. California Bill's manual is guaranteed to be the finest.

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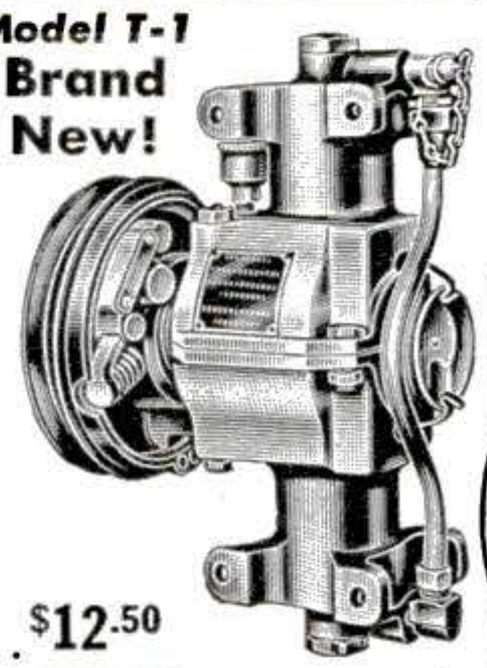
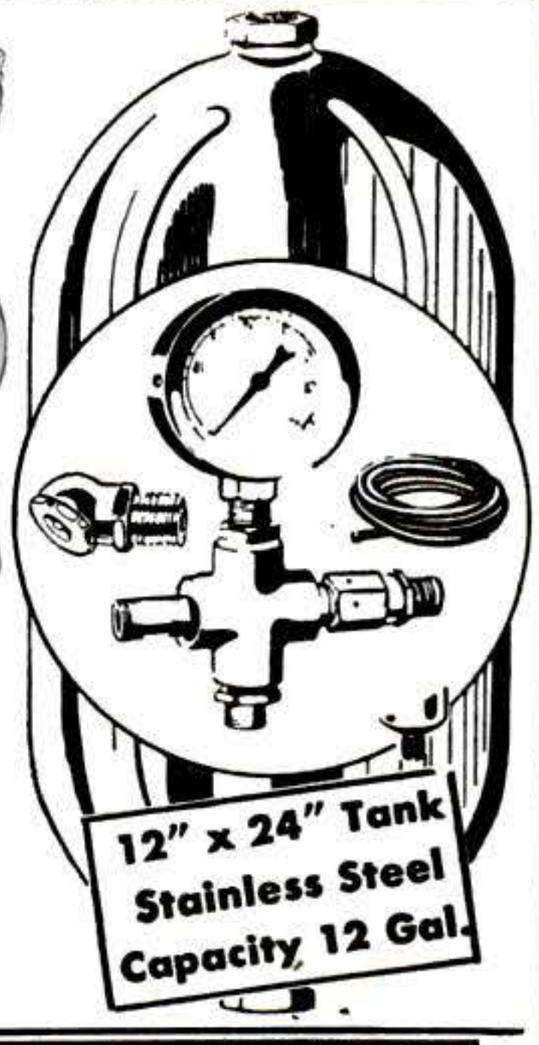
WESTINGHOUSE AIR COMPRESSOR

plus pressure tank, air gauge, air chuck, 20 ft. hose, pop valve, and fittings as shown.
COMPLETE OUTFIT OF 6 ITEMS ONLY

$31.50

Model T-1 Brand New!





Compressor Separately $21.50

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IDEAL for HOME • FARM • FACTORY
Wherever Compressed Air Is Needed

A fortunate purchase from the Government enables us to offer you this amazing buy at **a small fraction of the price of the manufacturer and of leading mail order houses.** All brand new. You get the Westinghouse Compressor and all of the accessories shown for **Only $31.50.** Shipping wt. 50 lbs. Designed for automotive truck or tractor mounting. Can be run off fan belt or power takeoff, or mounted horizontally. Comes with automatic clutch. Can be installed for use on farm trucks, jeeps, tractors, tire or garage service trucks, contractor or road building machinery, pneumatic devices, etc. Can be operated with ½ H.P. or more electric motor or equivalent portable gas engine. Replacement parts available.

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THE COMPRESSOR
Piston Type, 2-cylinder, 2 inch bore, 1½" Stroke Ball Bearing AUTOMATIC CLUTCH, OIL FREE AIR. 3.27 C.F.M. at 600 R.P.M. 6.54 at 1200. Suggested operating pressure 75 P.S.I. DIMENSIONS: 9" wide, 11⅞" high, 6⅝" deep. Wt. 26 lbs.

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12" x 24" stainless steel tank suitable for 150 lb. pressure. Two ¼" openings. Air gauge, pop valve, air chuck, 20 ft. hose and fittings as shown.

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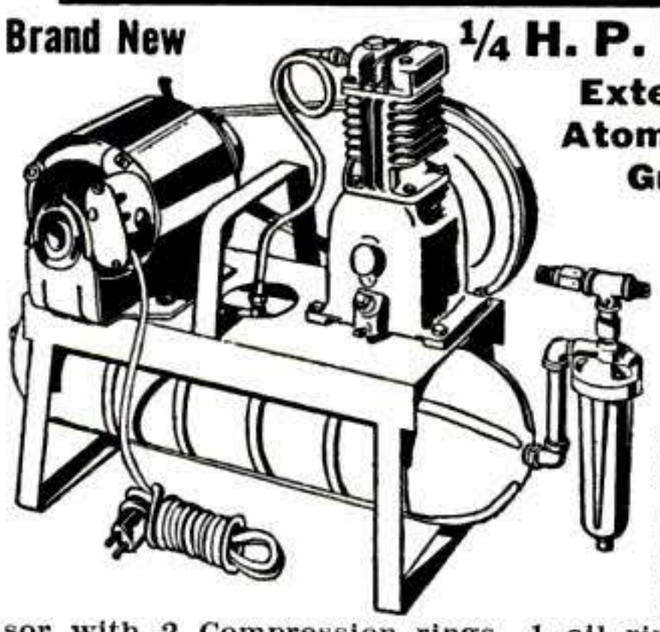
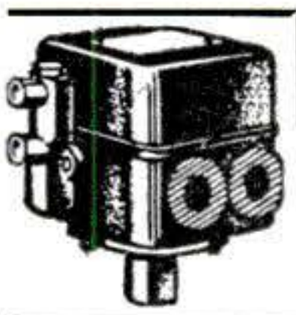
Brand New **¼ H. P. HEAVY DUTY**



External Atomizing Gun

Paint Sprayer mounted on 6 x 24 inch tank, ¼ H.P. 110 V. 60 cy. Heavy duty motor with overload relay, 10 ft. cord and plug, V Belt drive. Piston type Compressor with 2 Compression rings, 1 oil ring, 2 inch Bore, 1¾ inch stroke, displacement 2.86 C.F.M. at 60 lbs. pressure, Safety Valve. Gun **external atomizing.** Flat and round spray, quart cup; maintains 35 to 40 lbs. working pressure. Oil and water extractor, 1 air gauge, 20 ft. heavy duty 2-braid air hose with leak proof fittings, complete with carrying handle. Net weight 54 lbs., ship. wt. 60 lbs..... **$57.50**



Outfit less motor.....$47.50
Compressor only..... 17.50
Spray gun and 20 ft. hose..... 12.95

AUTOMATIC PRESSURE SWITCH WITH UNLOADER
Double pole, with 2 way release valve. Set at 125 to 150 lbs. pressure. Wt. 4 lbs. Only..... **$10.25**

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1/3 H.P. heavy duty capacitor motor AC 110/220 volt 60 cycle, 2 x 1¾ inch piston type compressor, splash feed lubrication, 12 x 24 inch tank, automatic pressure switch, pressure range 100 to 125 lbs., CFM 2.2, check valve, safety valve, air regulator with gauge and filter, 20-ft. air hose with air chuck for inflating tires. V. belt drive. Shipping wt. 90 lbs.

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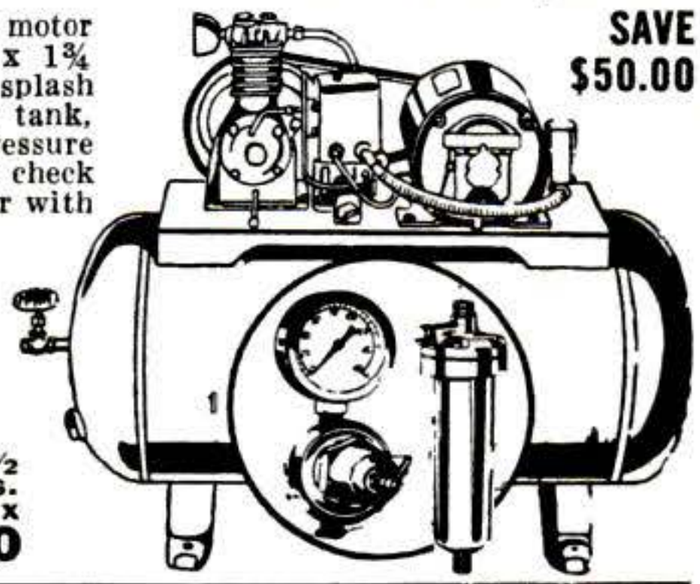

Special Price $79.50

Same unit as above with ½ H.P. motor. CFM 2.8 at 125 lbs. pressure, furnished with 13" x 24" tank. Shipping wt. 125 lbs..... $98.50

"Wellworth" CHECK VALVES

¼" valve $2.75
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CP4X Pistol grip handle. Takes up to 3/16" rivet. Weight 6 lbs. List price $73.00.

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TRY THIS AMAZING WELDER at your local Lincoln Weldealer

See how easy it is to—

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Get full details in Bulletin 370. Consult your telephone directory for nearest Lincoln Weldealer or write The Lincoln Electric Company, Dept. 202, Cleveland 1, Ohio.

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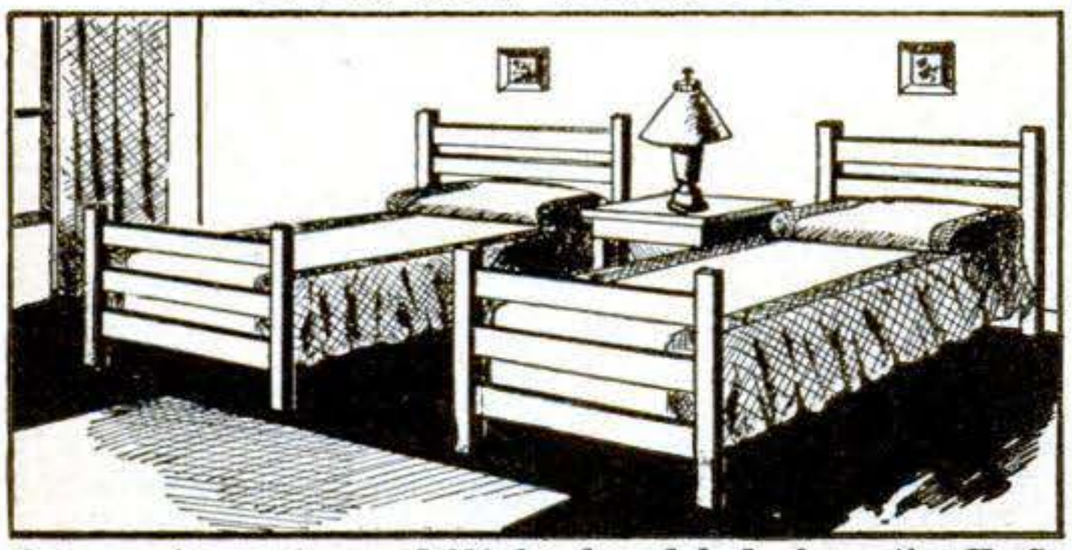
Complete Set $27.50

$50.00 VALUE

This price includes two (2) hardwood beds, two (2) bedsprings, two (2) thick cotton mattresses, and two (2) fluffy feather pillows.

TWIN BEDS



Our purchase of over 5,000 **hardwood beds** from the U. S. Air Force makes this low price possible. These beds can be made into double bunks or twin beds and are real space savers for your summer cabin, guest room, children's room, etc. These beds are of sturdy hardwood construction. Will hold over 600 lbs., 30" wide, 76" long. Mattresses have new ticking. The pillows have had the feathers removed, and cleaned in live steam. The ticking washed and bleached then refilled with soft fluffy, clean feathers. All sterilization regulations have been complied with. Seal is on all mattresses and pillows. Shipping weight for complete set (2 beds, mattresses, pillows) is 150 lbs. We pay one half of all freight charges.

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All beds shipped via truck or rail freight f.o.b. Fresno. Remember— we pay one half of all freight charges on these beds.

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Size 64" x 82"—Color, grey or olive drab—**$5.95 ea. We pay all postage** or express charges on this item.

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12" BRAKE. Fits in vise to form difficult and compound bends, up to 20 gage steel 12" wide, $12.50 PP.

SHEAR. Cuts 16 gage steel any length and width, $12.50 P.P.

SHEET METAL PLIERS. 2½" wide, $2.00; 5", $3.50.

Immediate delivery. Order direct, cash or C.O.D., or send for folder.

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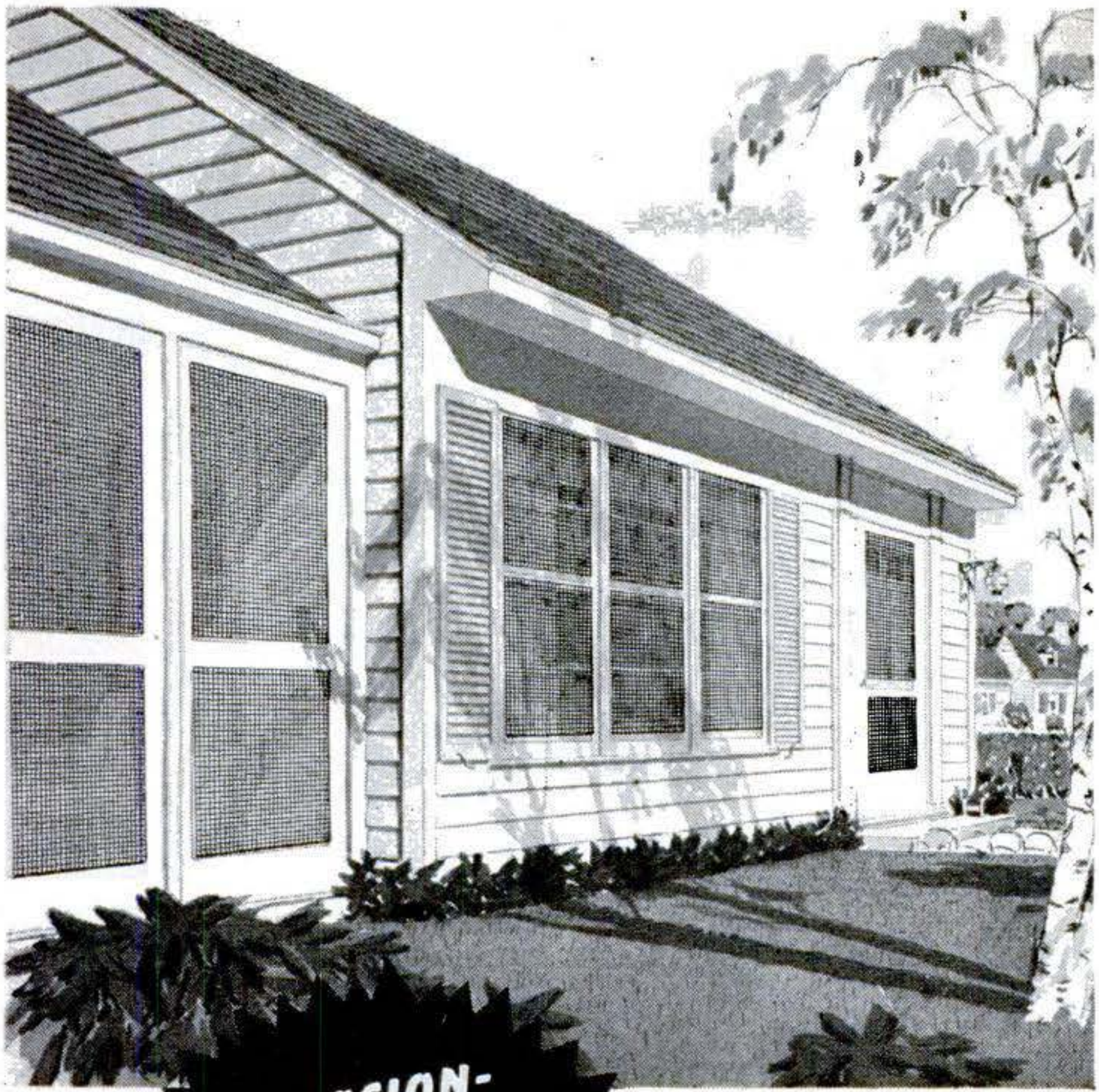

amazing LUMITE screening is LONGER LASTING because it's rustproof

CORROSION-PROOF
CAN'T STAIN THE HOUSE
AMAZINGLY STRONGER

Name the enemies of ordinary screening:—salt air and salt fog . . . industrial smoke . . . rain or snow. *Not one of these has any effect on* LUMITE.

Here at last is a screening that can be unconditionally guaranteed never to rust, rot or corrode . . . guaranteed never to stain your house. Yet this new miracle plastic screening costs only 11½¢-12¢ per square foot—little more than the cheapest . . . less than any other quality screening.

It's easy to frame . . . and so strong that when properly framed it will never sag or bulge. Punch it. You'll see it give, then regain its original tautness.

Insist on LUMITE for your new house or when replacing old screens. On sale at leading hardware, lumber and building supply dealers.

For free sample and further information, write Dept. PS-3, LUMITE DIVISION, Chicopee Manufacturing Corporation of Georgia, 47 Worth Street, New York 13, N. Y.

Facts for Architects and Builders:

Effects of acids, alkalies and solvents—Essentially none.

Effect of age—Independent scientific tests indicate that LUMITE is more durable than any other type of screen cloth under all climatic conditions that might normally be encountered.

Non-inflammable—Will not support flame . . . is self-extinguishing. Softening point, 240°F.

Tensile strength—Up to 40,000 lbs. per square inch.

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Installation—Cut with ordinary scissors. Fold edges under one-half inch. Tack or staple the screening smoothly and evenly every 1½". Because of inherent characteristics, LUMITE will gradually draw itself into a snug, firm fit. For correct methods of machine framing, consult LUMITE engineers.

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Replacement or Refund of Money — Guaranteed by Good Housekeeping — If Not As Advertised Therein

LUMITE*

woven saran screening

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For CRACKS in Concrete

Don't let cracks, widened seams, shallow holes in *your* concrete basement or garage floor cause you trouble! Fill them with Smooth-On No. 7B Quick Floor Patch Cement. Finish level with surrounding surface. The repair hardens in a few hours and is then ready for use. Ask for Smooth-On No. 7B Quick Floor Patch *by name and number*, in 1-, 5-, 20- or 100-lb. sizes. If your hardware store hasn't it, write us.

FREE **7B LEAFLET and SMOOTH-ON HANDBOOK**

Leaflet shows how to use No. 7B. Handbook shows time-saving, money-saving home repairs you can make with other Smooth-On Cements—leaks stopped, cracks sealed, loose parts made tight. 40 pages. 170 pictures. Write us for both—FREE—today.

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Do it with SMOOTH-ON QUICK FLOOR PATCH CEMENT

THAT ACCURATE TOUCH...

with the FINEST IN STEEL TAPES

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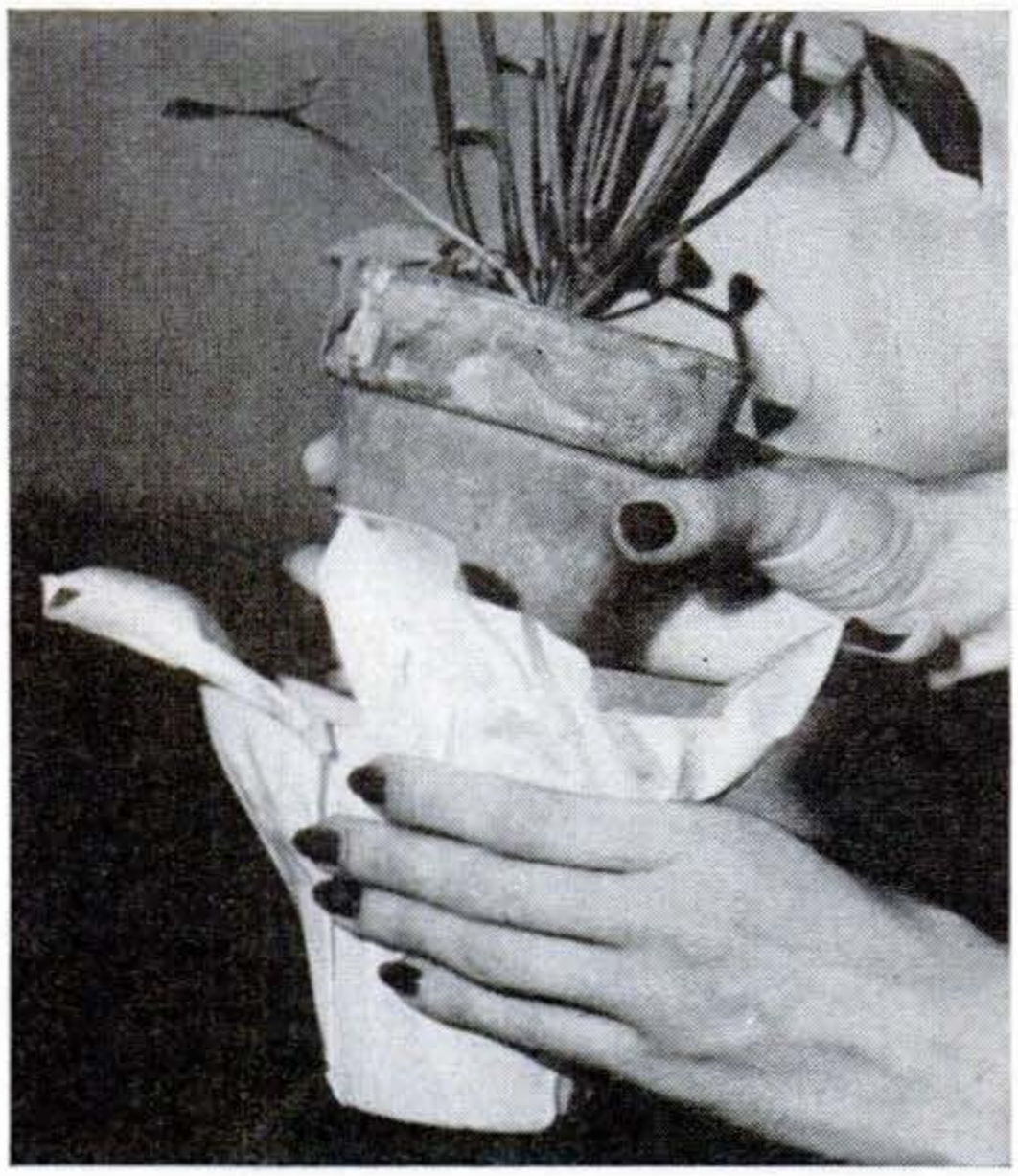
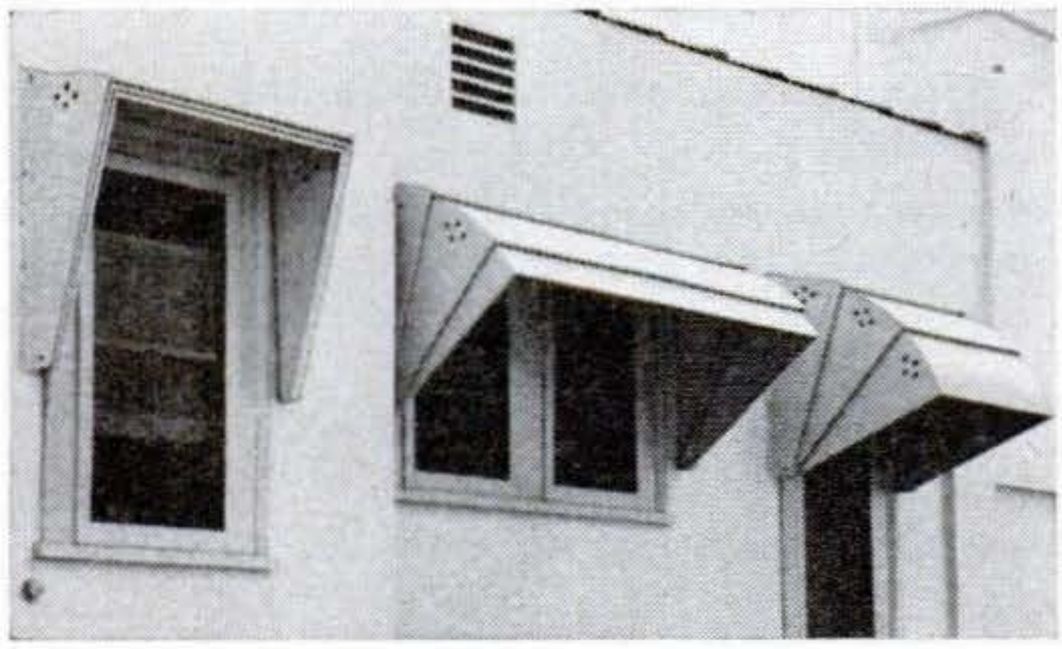


Plastic Flower-Pot Container. Water is poured into this decorative Vinylite® flower-pot holder rather than into the pot itself. The plant receives moisture by absorption. It's sold by Mary Donlan Ver Mett, Fenton, Mich., for 35 cents.



Aluminum Awning. This awning can be raised or lowered to any pitch from inside the window by a crank attached to a stainless-steel cable. All parts are fireproof and weatherproof. The maker, Spartan Company, Inc., Los Angeles, offers the awnings in a wide range of colors that blend with most decoration schemes. The colored enamel is baked on aluminum. Awnings are custom-built for any windows.

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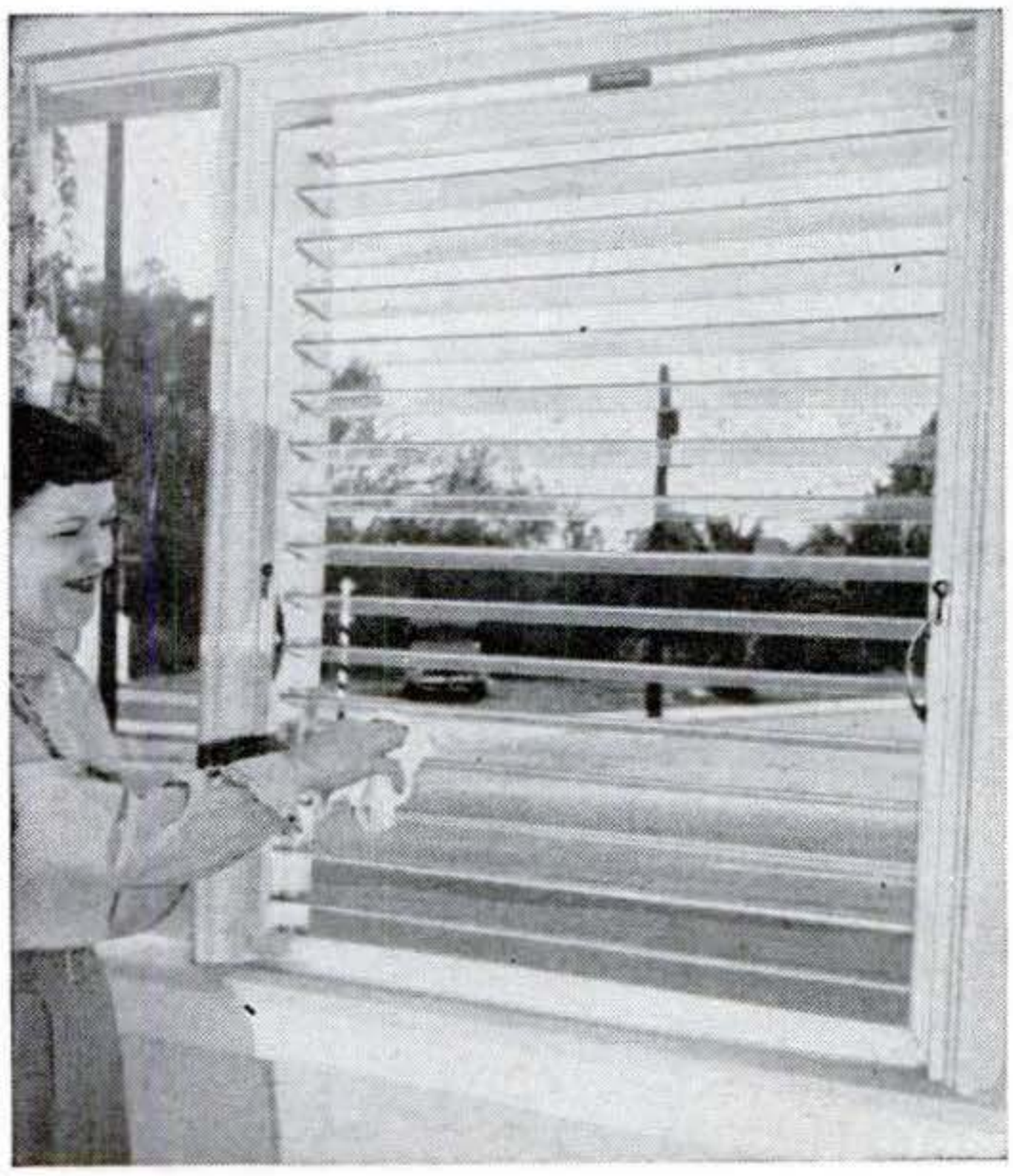
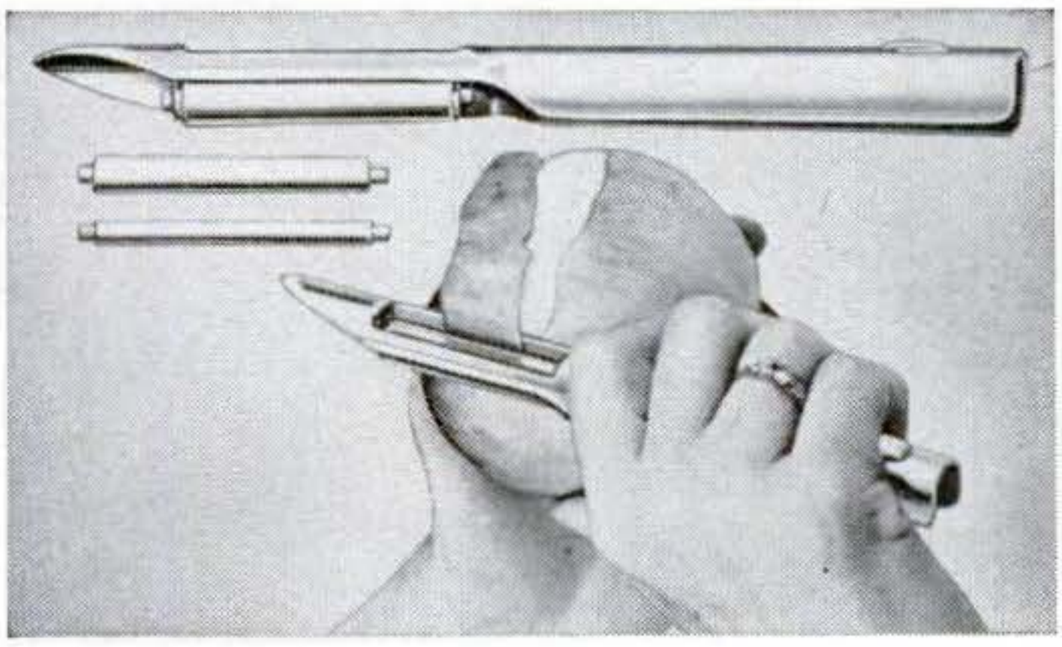
Modern Living



Window Made of Glass Slats. Closely resembling a Venetian blind, this window is composed of slats of ¼" plate glass. Designed by the Bishop Ventiglass Co., Pasadena, Calif., it gives controlled ventilation. Handles open the strips.



Three-Way Peeler. The Roll-Eze® parer and slicer cuts right- or left-handed and can be set to slice three different thicknesses. Priced at about $1 by Scott & Camden Co., Jackson, Mich., the peeler comes with three rollers. Any of these can be clipped into the knife to turn out fine, medium, or coarse slices. It's made of stainless steel and may be sharpened with a hone or a fine file.

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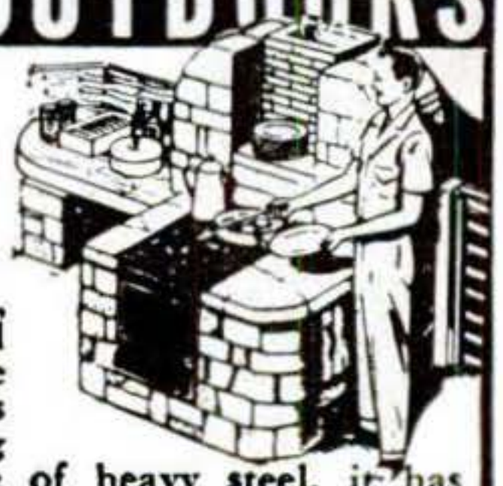

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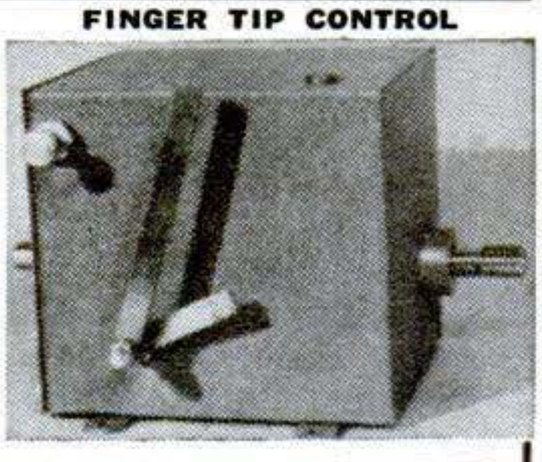

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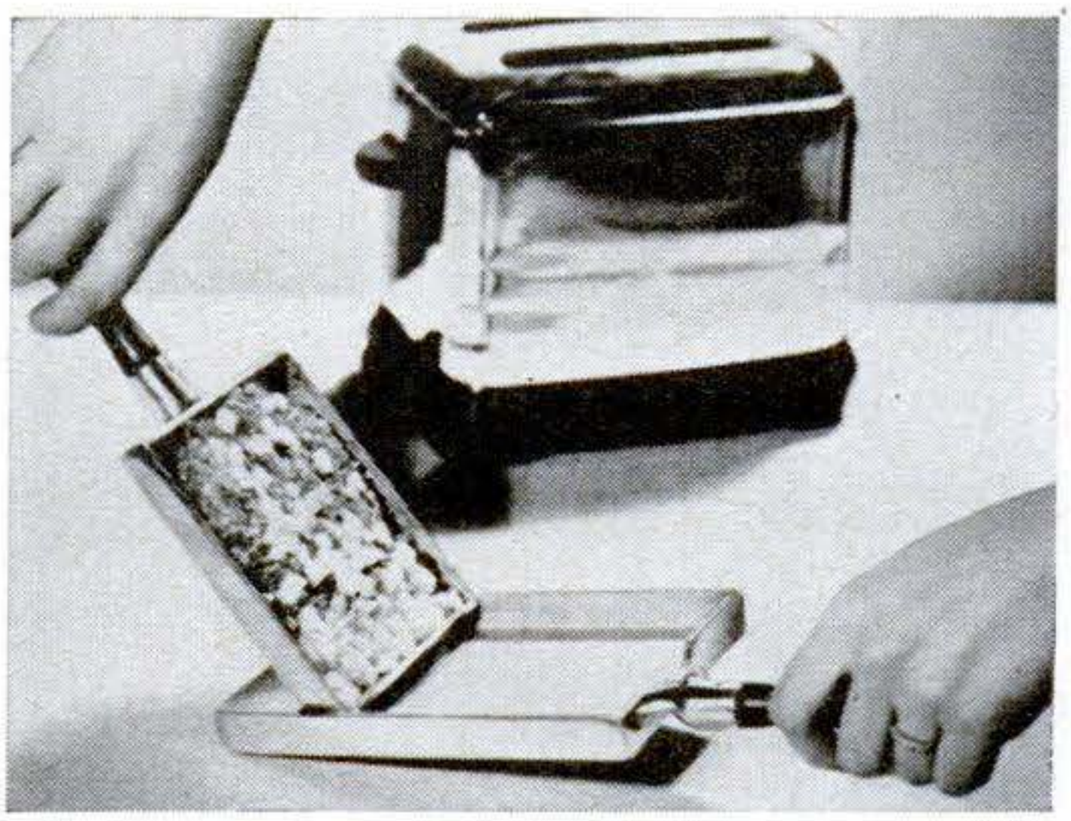

Cooks Meat in Toaster. The Bartz Snacker®, designed by F. H. Bartz, Chicago, fits into pop-up toasters to cook hamburgers, bacon, and other foods. It's made of pressure-cast aluminum about 1/32" thick. Overall length from end of handle to base is about 11"; width is 4¾". Food juices collect in the bottom of one side.

Combined Stove-Refrigerator. Three layers of insulation under the stove (either gas or electric) prevent transfer of heat to the 4-cu. ft. refrigerator. Seven settings are offered by the temperature control on the refrigerator. The General Air Conditioning Corp., Los Angeles, prices the units at $230 to $240.

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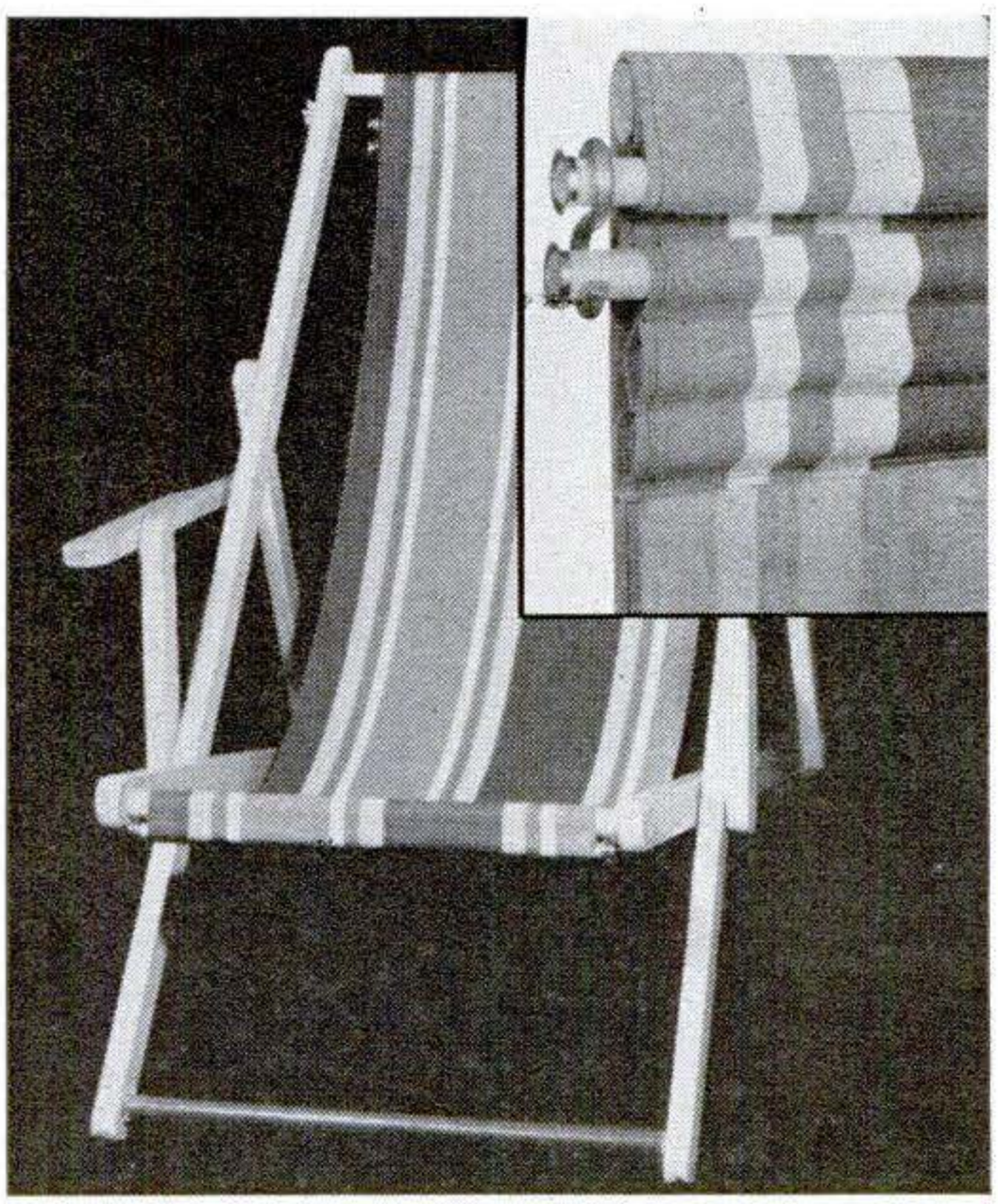
Meters Coffee Automatically. Each time the knob is turned the Cofi-Metr® pours out a teaspoonful of coffee. Flavor is retained by the air-tight friction cap. The plastic dispenser and a 1-lb. decorated jar retail for $1. Over-all height of the jar and dispenser is about 10″. The maker is Steward Industries, Inc., Chicago.



Replacement Seat Hooks On. Beach chairs that are ready for the discard because of damaged canvas can be given new life with this replacement seat. No sewing or tacking is necessary. After the old canvas is cut off, the new seat is snapped in place with rustproof hooks. The price is $1.89. M. D. Pinner Company, New York.

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Ladd Haystead—agricultural counselor.

TO: Reader
FROM: Editor

What Haystead Sees You Can Believe

RED-FACED and hearty, Ladd Haystead pushed his chair back and roared. The idea was preposterous. He should know. Fumigate the soil? Been tried thousands of times. It never worked. Terrific story, of course, if true, but it can't be true. Sure, he would look in on it, because he was going to that part of California anyway. But smart editors don't reserve space for stories that haven't a thousand-to-one chance.

That was early last winter. Haystead went West, and we stayed East, never giving the thousand-to-one shot another thought. Then in February came a wire from San Francisco:

SOIL RENOVATION STORY STANDS UP DEFINITELY. HAVE WORKED IT FOR FOUR HUNDRED MILES BUT WILL HAVE TO FINISH IN EAST WHERE I HAVE BACKGROUND MATERIAL AND STATISTICS. HAYSTEAD.

So the big guy in the checkered shirt had changed his mind. You can read the results on page 104. With his telegram, and later with his story, our skepticism disappeared. For, despite some mysterious aspects of George Woods' machine, we know that the machine works—because Haystead says so. He talked to farmers for miles around, gathered their affidavits, and wrote his story. He is a good reporter. His name and reputation as a farm journalist mean as much to him as the name of POPULAR SCIENCE does to us.

Haystead calls himself an "agricultural counselor." That's fancy language for a working farmer and farm journalist. He has studied farmers, farms, and farming in all 48 states, has owned or managed farms in 15 of them. He writes for farmers, and about them. His interpreter's role is unique: industrialists hire Haystead to tell them what farmers need; farmers pay to read Haystead on industry and industrial products for the farm.

Twice a year he listens and talks his way up and down and across this country. Six feet two, and well over 200 pounds, he might have been a Northwest logger, and was. His voice is that of a played-out foghorn—at 14 he ran away to join a circus and became a carnival barker. His wit is Irish, and so is Haystead. He is also combative; you will understand why if you can find a copy of "Preacher's Kid" (Putnam), in which he tells of life out of a Presbyterian parsonage on the British Columbia-Washington border about 35 years ago.

As a kid he beat a path between the local print shop and the frontier farm where he lived. He has maintained that dual arrangement ever since. He is a great believer in the American soil, and in the American men and women who work it for a living. He wouldn't be telling the story of George Woods and his soil fumigator if he didn't believe it would help them.

Fred Newman

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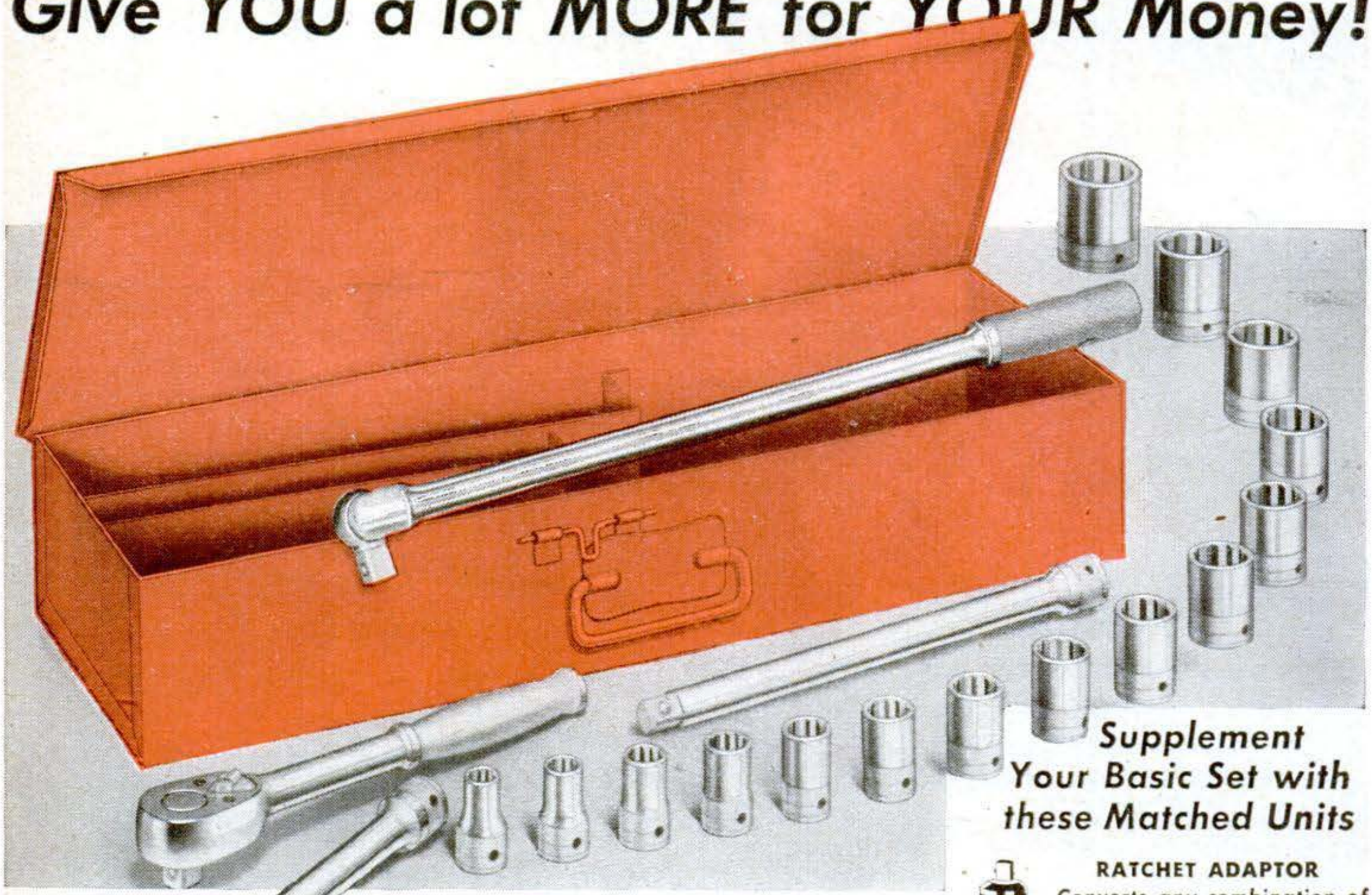

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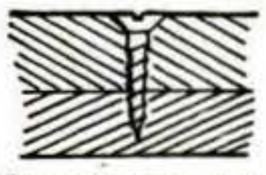
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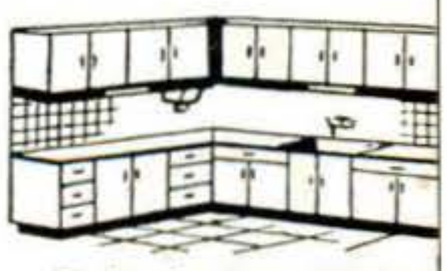
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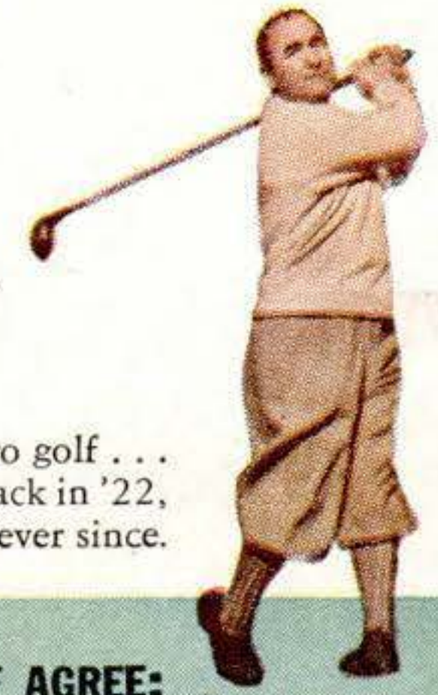

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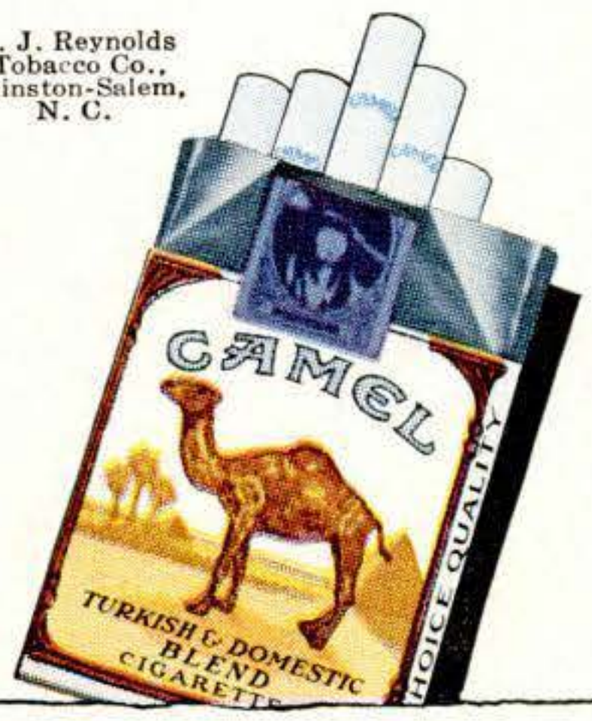

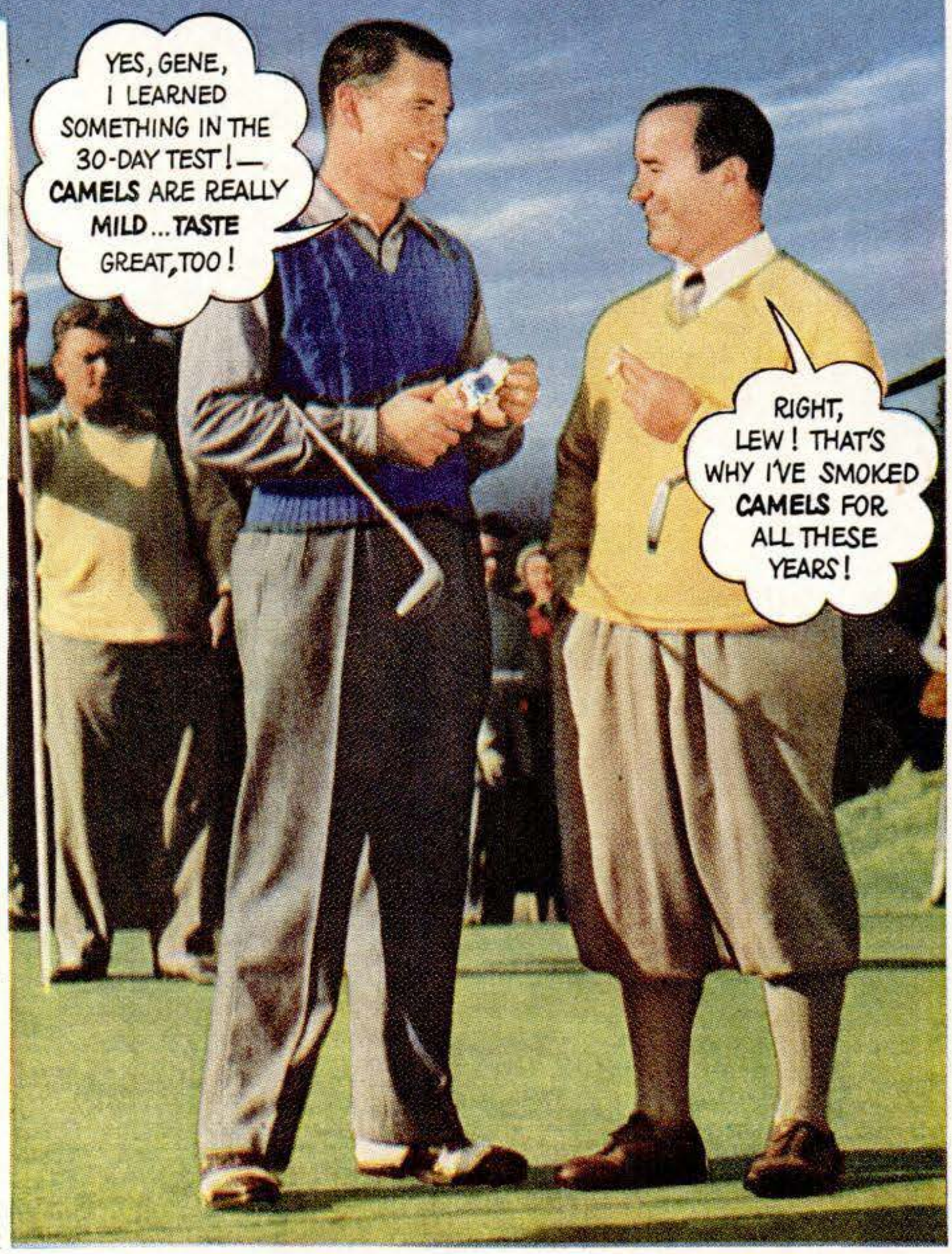

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